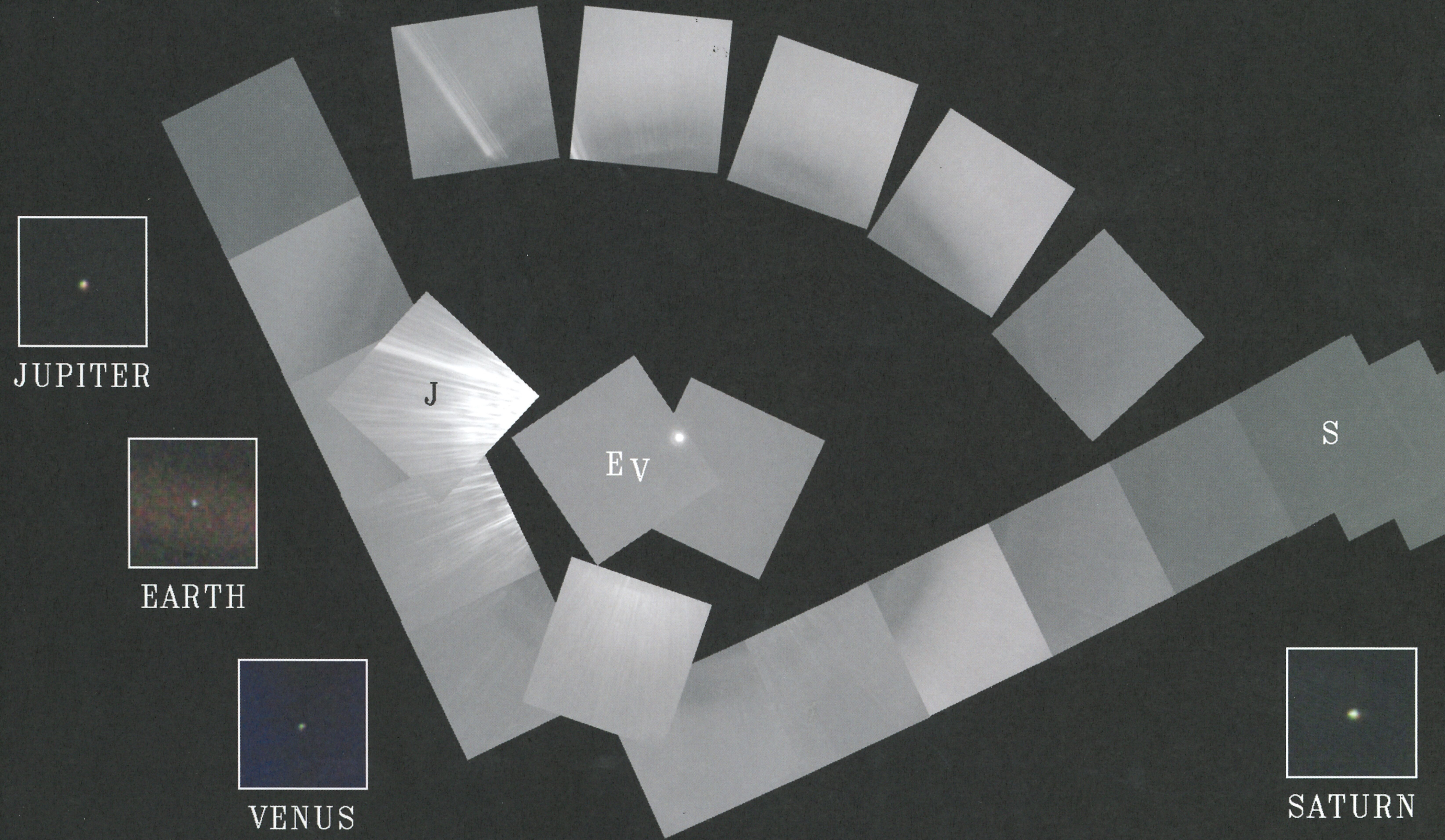
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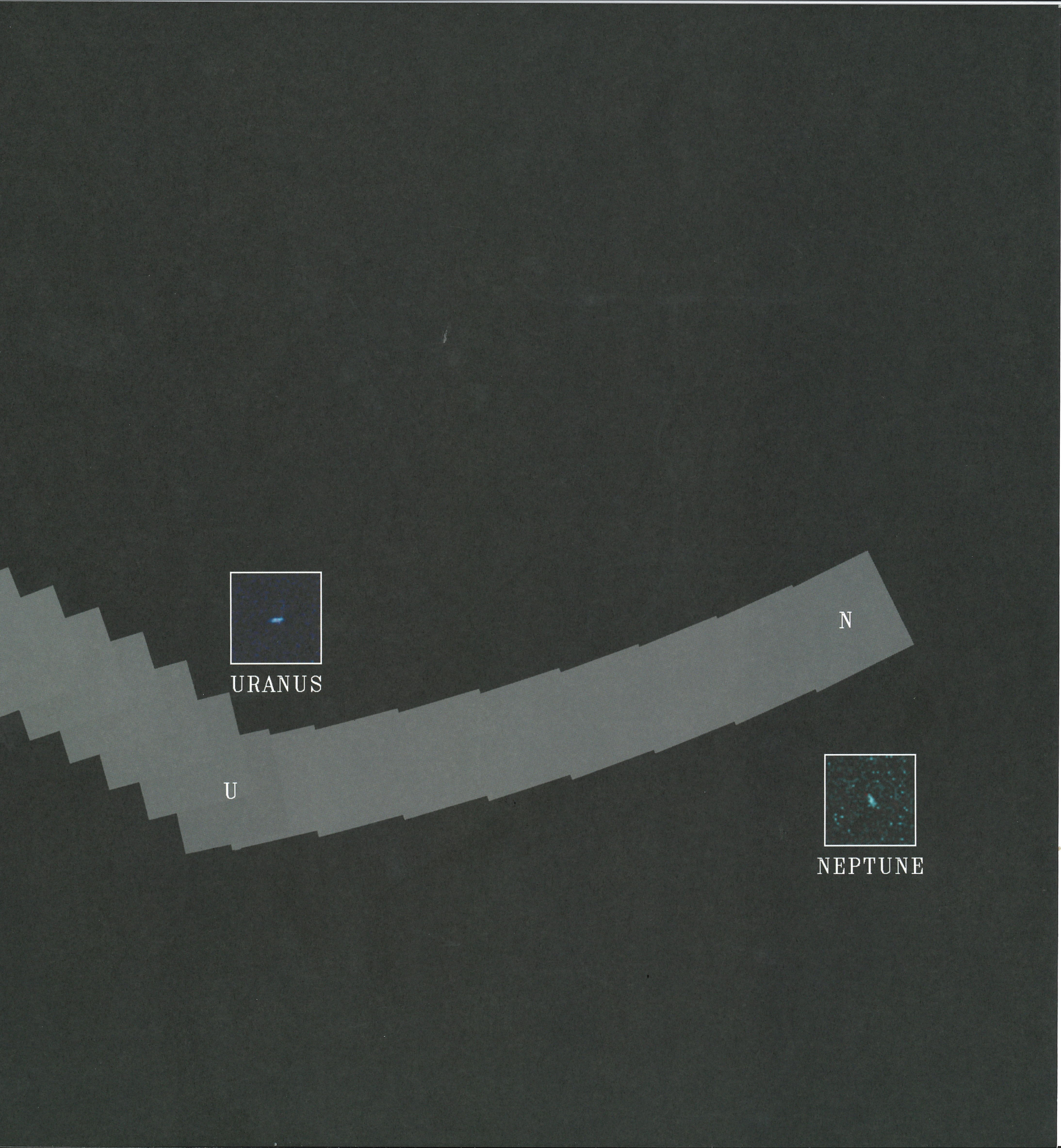
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"The launching of this bottle into the
cosmic ocean says something very
hopeful about life on this planet."
—Carl Sagan

THE VOYAGER GOLDEN RECORD

PRODUCERS David Pescovitz, Timothy Daly, and Lawrence Azerrad

CONSULTING PRODUCER Timothy Ferris

VOYAGER INTERSTELLAR RECORD COMMITTEE (1977)

Carl Sagan, chairman, executive director

Frank Drake, technical director

Ann Druyan, creative director

Timothy Ferris, producer

Jon Lomberg, designer

Linda Salzman Sagan, greetings organizer

OZMA RECORDS

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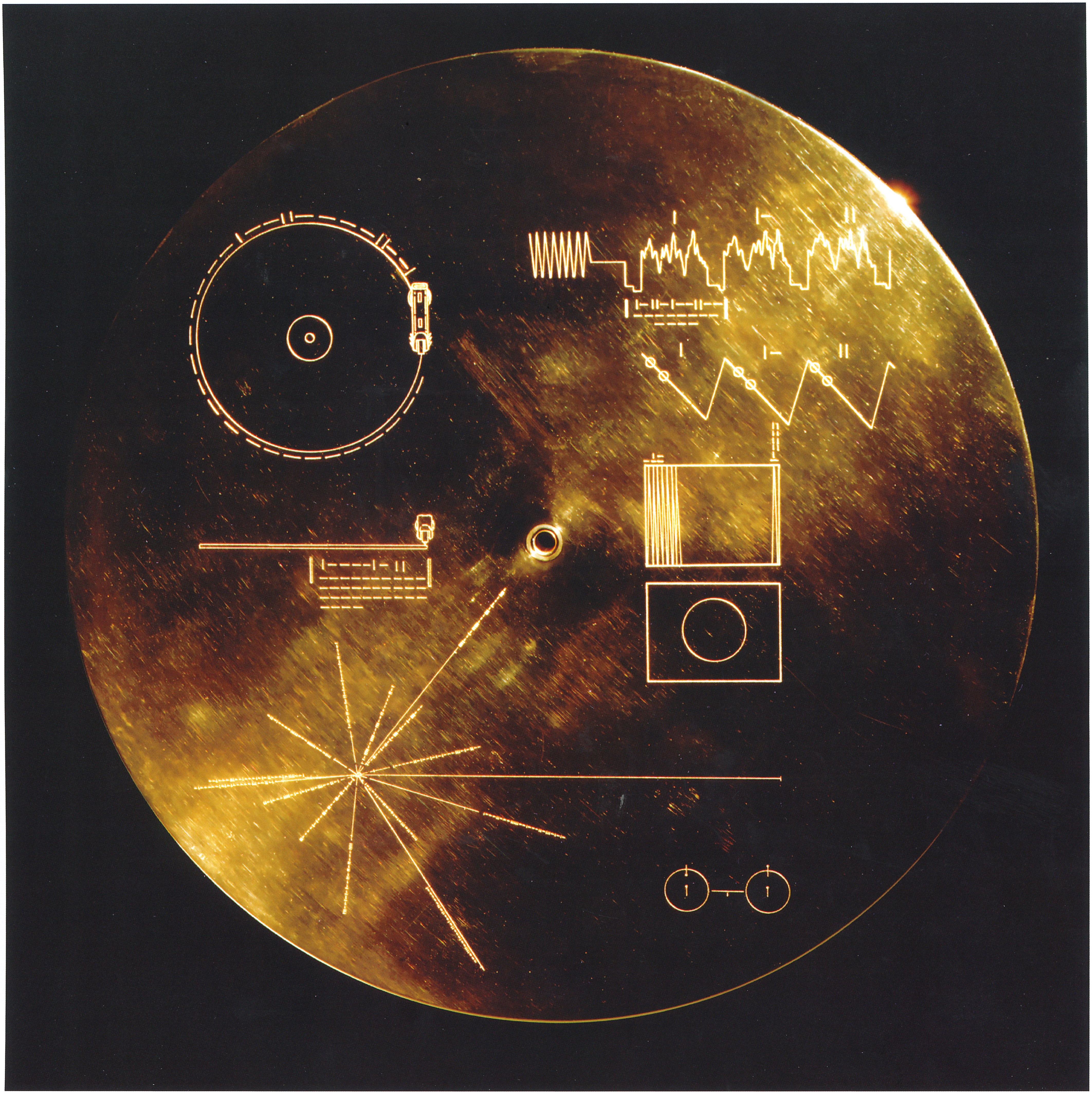


INTRODUCTION

by David Pescovitz, Tim Daly, and Lawrence Azerrad

In 1977, NASA launched two spacecraft, Voyager 1 and 2, on a grand tour of the solar system and into the mysteries of interstellar space. Attached to each of these probes is a beautiful golden record containing a message for any extraterrestrial intelligence that might encounter it, perhaps billions of years from now. This enchanting artifact, officially called the Voyager Interstellar Record, may be the last vestige of our civilization after we are gone forever.

The golden record tells a story of our planet expressed in sounds, images, and science: Earth's greatest music from myriad peoples and eras, from Bach and Beethoven to Blind Willie Johnson and Chuck Berry, Benin percussion to Solomon Island panpipes. Natural sounds—birds, a train, a baby's cry, a kiss—are collaged into a lovely audio poem called "Sounds of Earth." There are spoken greetings in dozens of human languages—and one whale language—and more than 100 images encoded in analog that depict who, and what, we are.

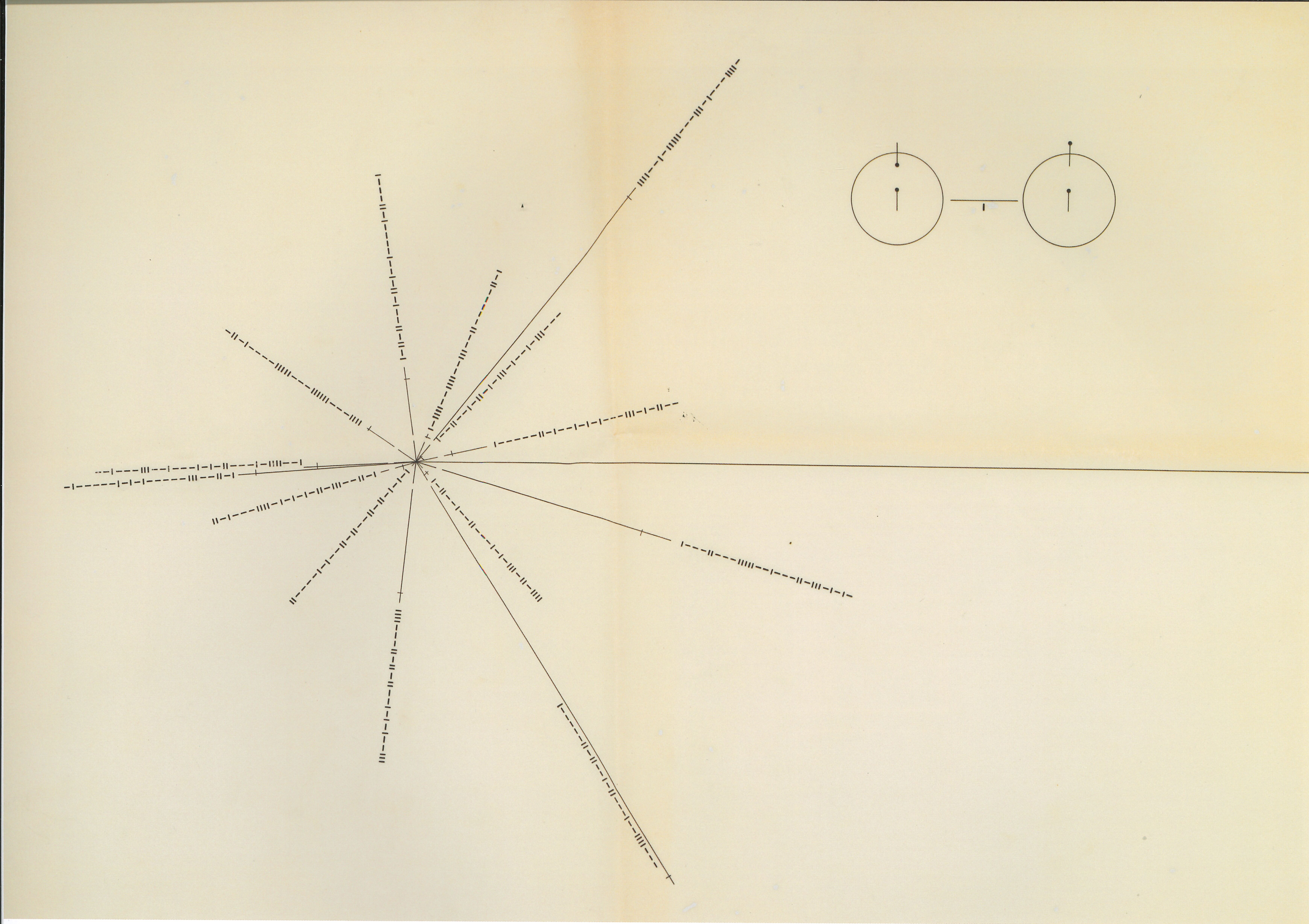
Astronomer and science educator Carl Sagan chaired the Voyager Interstellar Record Committee that created this object, which is both an inspired scientific effort and a compelling piece of conceptual art. Astronomer Frank Drake, father of the scientific search for extraterrestrial intelligence (SETI), was the technical director, writer and novelist Ann Druyan was the creative director, science journalist and author Timothy Ferris produced the record, space artist Jon Lomberg was the designer, and artist Linda Salzman Sagan organized the greetings.

As we embarked on our own effort to make the golden record available on vinyl for the first time, in celebration of Voyager's 40th anniversary, we realized that we saw the project through three different lenses. As an exquisitely curated music compilation, the Voyager record is an inviting port of entry to unfamiliar yet entrancing sounds from other cultures and other times. As an objet d'art and design, it represents deep insights about communication, context, and the power of media. In the realm of science, it raises fundamental questions about who we are and our place in the universe. At the intersection of those three perspectives, the Voyager record is a testament to the potential of science and art to ignite humanity's sense of curiosity and wonder.

Voyager 1 entered interstellar space in 2012. As of this writing, it's almost 21 billion kilometers away from Earth. Speeding along at 17 kilometers per second, it will take another 40,000 years before the spacecraft passes within 1.6 light-years of a star in the constellation Camelopardalis. The slightly slower Voyager 2 is at the outermost edge of our solar system, where the sun's plasma wind blows against cosmic dust and gas. Soon, it too will venture into interstellar space.

We may never know whether an extraterrestrial civilization ever listens to the golden record. It was a gift from humanity to the cosmos. But it is also a gift to humanity. The record embodies a sense of possibility and hope. And it's as relevant now as it was in 1977. Perhaps even more so.

The Voyager Interstellar Record is a reminder of what we can achieve when we are at our best—and that our future really is up to all of us.



Original hand-drafted artwork of Frank Drake's pulsar map.

VOYAGERS IN SPACE & TIME

by Timothy Ferris

We inhabit a small planet orbiting a medium-sized star two-thirds of the way from the center to the edge of the Milky Way galaxy's visible disk—about where track two might be on an LP record. The disk measures 100,000 light-years in diameter (meaning light takes 100,000 years to cross it) by only a few hundred light-years thick. The sun and all the stars we see at night orbit the center of the galactic disk at velocities of approximately 250 kilometers per second. The galaxy resembles a *spinning* record.

As science writers like to remind us, we humans may not amount to much in the cosmic scheme of things. We're tiny—if the galaxy were an LP, the solar system would be smaller than an atom—and our species has existed for fewer than 2 million years, whereas the galaxy is more than 13 billion years old. Our scientists make remarkable discoveries, but most humans remain mired in ignorance, faith, and fear. Yet there is something in us so expansive that we made a time capsule full of music and flung it out into the wider galaxy. Indeed, we made *two* of them.

1. The Mission

The two identical Voyager space probes were launched from Cape Canaveral, Florida, in August and September 1977, on a mission to explore the solar system's giant outer planets. Both craft reconnoitered Jupiter and Saturn. Voyager 1 swung close to Saturn's intriguing moon Titan, a detour that lofted the probe out of the plane of the solar system. Voyager 2 investigated Uranus and Neptune before continuing into the depths of space.

The Voyager mission was unique, made possible by a rare alignment of planets and a momentum-transfer maneuver, sometimes called gravity-assist, that accelerated the spacecraft as they passed each planet without using any extra fuel. The Voyager probes started out with enough speed to leave Earth behind but not enough to get past Jupiter. They gained velocity by approaching Jupiter from behind, in terms of its orbital motion, and then departing on an angle such that Jupiter lost a tiny bit of momentum while each Voyager gained a lot. The probes repeated this momentum transfer at Saturn—and at Uranus and Neptune, in the case of Voyager 2—which got the spacecraft moving so fast that they need never return to the realm of the sun.

Today, both Voyagers continue sending back information about the behavior of magnetic fields, the solar wind of particles emitted by the sun, and the high-velocity subatomic particles called cosmic rays out where the solar system's environment gives way to that of interstellar space. Scientists define the solar system as residing inside the invisible, tear-shaped plasma bubble that forms where the solar wind stalls against the interstellar wind of particles adrift among the stars. Voyager 1 has passed that point and entered interstellar space, with Voyager 2 not far behind.

Both probes are so far away that their radio signals, traveling at the speed of light (300,000 kilometers per second), take more than 15 hours to reach Earth. They arrive with a strength of less than a millionth of a billionth of a watt—so weak that the three dish antennas of the Deep Space Network's interplanetary tracking system, in California, Spain, and Australia, had to be enlarged to stay in touch with these farthest of spacecraft.

The Voyagers' scientific mission will end when their plutonium-238 thermoelectric power generators fail, sometime around the year 2030. Thereafter, the two craft will endlessly drift among the stars of our galaxy—unless someone or something eventually encounters them. With this prospect in mind, each probe was fitted with a copy of what has come to be called the "golden record." Etched in copper, plated with gold, and sealed in aluminum cases to protect them from the impacts of interstellar dust and cosmic rays, the records are expected to remain intelligible for more than a billion years, making them the longest-lasting objects ever crafted by human hands.

Although they started out as explorers of space, the Voyagers will wind up more like time capsules. If you perched on Voyager 1 today—which would be

possible, if uncomfortable; the spidery craft is about the size and mass of a subcompact automobile—you'd feel no sense of motion and have little to see but stars in every direction. The brightest star would still be the sun, a glowing point of light below Orion's foot, with Earth a dim blue dot lost in its glare. Remain patiently onboard for millions of years, and you'd notice that the positions of a few relatively nearby stars were slowly changing, but that'd be about it. You'd find, in short, that Voyager was not so much flying to the stars as swimming among them.

When asked where the Voyagers will eventually go, scientists obligingly reply that in 40,000 years, Voyager 1 will pass 1.6 light-years from the star Gliese 445, while Voyager 2 will get to within 1.7 light-years of another dim bulb called Ross 248. But from your onboard perch, you'd merely see that Gliese 445 or Ross 248 became brighter over the next 40,000 years, and then dimmed again. The experience of "encountering" stars at such distances resembles that of castaways in a lifeboat watching the lights of ships passing on the horizon. The logic behind the golden record is less that the probes might someday end up someplace interesting and more that they'll last long enough for a spacefaring civilization possibly to detect and intercept one of them. What matters isn't how far they'll travel but how long they'll survive.

Are there, or will there ever be, intelligent beings out there to snare the spacecraft and play the record? Time looms equally large in such speculations. If smart creatures emerge on one in a million planets and typically build civilizations lasting millions of years, there ought to be quite a few in the galaxy right now. If, on the other hand, civilizations tend to blow themselves up or otherwise expire on timescales of only a few thousand years, they'll be rare *at any given time*.

Taking time into account helps explain why no spacefaring aliens have landed on the White House lawn. Suppose they do exist, and that some have visited Earth at some random point in the past: What is the likelihood that humans would have witnessed their visit? Earth is 4.5 billion years old. The first humans capable of speech, so that they could at least have handed down an oral record of such a momentous event, emerged around 100,000 years ago. The odds of aliens having visited Earth while humans were here to witness it and tell their children about it are, therefore, 4.5 billion divided by 100,000, or one in 45,000. Had a *hundred* such starships stopped by our planet, the likelihood of our knowing about it today would still be under a quarter of one percent.

Rather than squandering their resources on a brief "flags-and-footprints" landing on Earth, however, aliens would likely find it more cost-effective to send small, robotic probes to orbit the sun and report back for long periods of time. Miniaturized for economical interstellar travel, embedded in asteroids for protection from cosmic rays, and transmitting signals to their home planet or to an interstellar network in directions that don't intercept Earth, many such probes could be orbiting the sun right now without our having detected any of them. We simply don't know enough about extraterrestrial life to state with any confidence whether the golden records will ever find an audience.

Nor can we anticipate what the records might communicate to extraterrestrials. While I don't envision them dropping the needle in a groove and instantly rocking out, I'd also be surprised if the records made no sense to extraterrestrials at all. Without venturing into undue assumptions, I think they'd adduce at least this much about the spacecraft and its odd cargo:

- This object is a product of technology, not biology. Somebody or something made it.
- Its purpose was to gather and transmit data, presumably back to whoever dispatched it. Its transmitter power and antenna size indicate a maximum communication range on scales of light-hours, not light-years, suggesting that it functioned within the same planetary system in which it originated. All its components—sensors, transmitters, propulsion and orientation rockets, nuclear power generator, etc.—are consistent with such a mission.

- All, that is, except one. Attached to the object is an aluminum housing containing a disc etched on both sides with spiraling grooves. These grooves contain complex patterns. An analog electronic device attached to the object includes a diamond that nests neatly into the grooves.
- An inscription on the housing provides instructions for how to use the analog device to interface with the disc. When outputted according to the instructions, electrical waveforms are generated.
- The density of the medium into which these pulses were intended to be generated is not specified, but analog images encoded in the grooves show a rocky planet with water and an atmosphere. Accordingly, the pulses may best be deployed either in water or in a gas with a density characteristic of rocky planets.
- The photographs show structures and biological beings, mostly on the planet's surface rather than underwater. We conclude that the pulses are intended for propagation into an atmosphere.
- There is no evidence that the disc was meant specifically for us or that its makers knew of our existence—if, indeed, we yet existed when it was dispatched.
- Therefore, it appears to be a gift, proffered without hope of return.

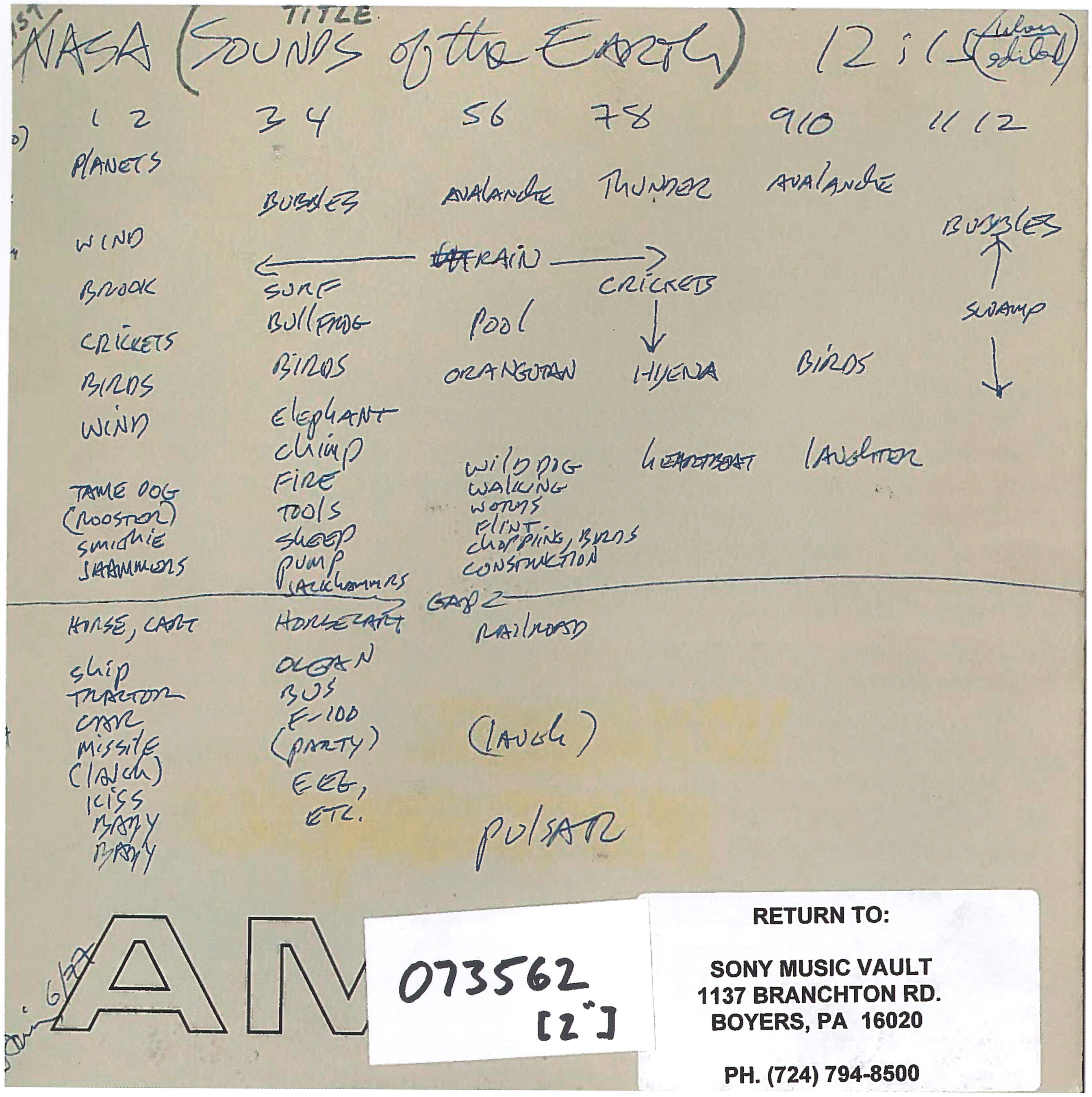
2. How the Golden Record Came to Be

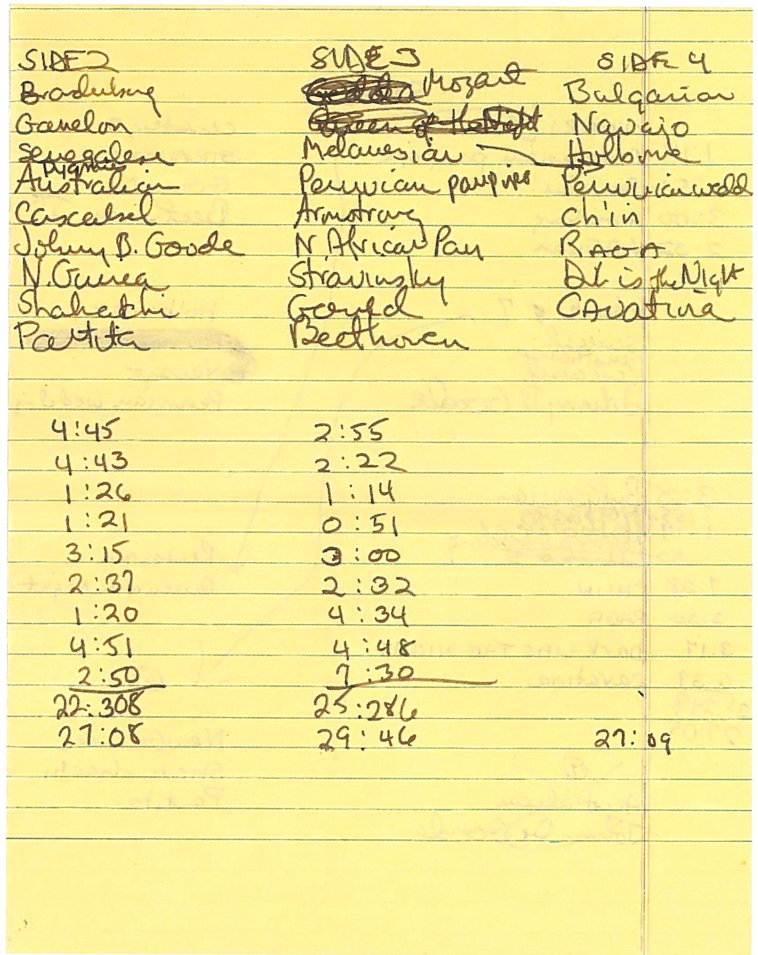
The golden record idea originated in January 1977, during a conversation in Hawaii between the astronomer Carl Sagan and his Cornell University colleague Frank Drake. Two prior space probes—Pioneer 10 and 11, launched in 1971 and 1972, respectively—had flown past Jupiter and had been momentum-boosted to interstellar velocities. Noting that the Pioneers would become mankind's first interstellar probes and might therefore endure for billions of years in the near-vacuum of space, Sagan and Drake persuaded NASA to attach a six-by-nine-inch plaque to each Pioneer spacecraft. Widely reproduced in the press, the plaques featured line drawings of a man and woman, accompanied by a pulsar map indicating our location in the galaxy.

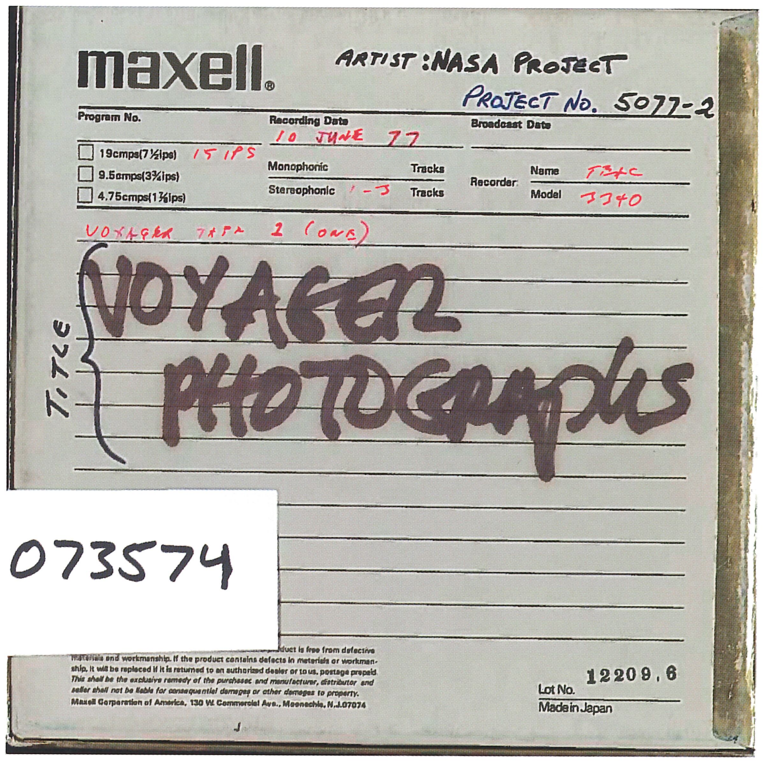
It occurred to Drake that the more robust Voyager probes might carry not a larger plaque, but a metal phonograph record. Information etched into the grooves of such a record could last a long time.

Sagan and I became friends in 1972. We shared a passion for science and music. When Carl was in New York, we'd listen to records on the big stereo in my place, a high-ceilinged West Side apartment perched amid Norway maples like a tree house. Music lovers in those days liked listening attentively to LPs played on good equipment. Lots of great music was being released, and there was something fascinating about LP technology in itself. A diamond dances along the undulations of the groove; its intricate motions vibrate an attached crystal (in the case of ceramic phono cartridges, like the ones attached to the Voyager probes); the vibrations generate a flow of electricity that's amplified and sent to the speakers. At no point in this process is it possible to say with assurance just how much information the record contains or how accurately a given stereo has translated it. You never knew whether a record might sound even better if played with a different phono cartridge, or at a different stylus pressure, or through different equipment. The open-endedness of the medium seemed akin to the grand gesture of sending a record to the stars—and, for that matter, to scientific research, where one is always aware that more can be learned.

A month before the Hawaii meeting, Carl was visiting with me and my fiancée at the time, Ann Druyan, and he asked if we'd help him put together a plaque or something of the sort for Voyager. We immediately agreed. As I later wrote Carl, "Twenty years ago when I used to go out every clear night and stare at Jupiter for hours through a telescope of 2.4 inches' aperture, it never occurred to me that spacecraft would reach that







ABOVE:
The box containing one of the Voyager Interstellar Record master tape reels, stored by Sony Music in an underground vault for 40 years, carries Timothy Ferris' notes on mixing the "Sounds of Earth" sequence.

TOP RIGHT:
Ann Druyan's original handwritten notes on the Voyager record's musical sequence and timing.

BOTTOM RIGHT:
The golden record's photographs were scanned and translated into audio tones, then inscribed into the record's stereo grooves.

planet in my lifetime, much less that I would ever have more to do with one than gawk at the rocket as it arched out through the skies."

Once NASA approved the record, we had less than six months to put it together, so we had to move fast. Ann went to work gathering material for the sonic description of Earth's history known as the "Sounds from Earth" segment. She came up with everything from whale songs, recorded with trailing hydrophones by the biologist Roger Payne, to the entire contents of the massive Elektra sound effects archive. Linda Salzman Sagan, Carl's wife at the time, went to work recording samples of human voices speaking in many different languages for the "Greetings" section. The space artist Jon Lomberg rounded up photographs, a method having been found to encode them into the record's grooves. He'd considered sending only works of art but wound up representing the planet more literally, with photos showing human anatomy, family and social life, villages and cities, hunting and transportation, and scientific tools, including a microscope and two radio telescopes. The photo sequence begins with a circle, to insure proper decoding, and ends with a string quartet and a page of sheet music from Beethoven's Cavatina, to tie in with the music. I agreed to produce the record, which meant overseeing the technical side and making sure all the record's disparate elements went together properly. We all worked on selecting the music.

I'd sought to recruit John Lennon, of the Beatles, for the project, but tax considerations obliged him to leave the country. Lennon did help us, though, in two ways. First, he recommended that we use his engineer, Jimmy Iovine, who brought energy and expertise to the studio. (Jimmy later became famous as a rock and hip-hop producer and record company executive.) Second, Lennon's trick of etching little messages in the blank spaces between the takeout grooves at the end of his records inspired me to do the same on Voyager. I wrote a dedication ("To the makers of music—all worlds, all times") and inscribed it in the space between the golden record's takeout grooves.

To our surprise, those nine words created a problem at the space agency. A NASA compliance officer, charged with examining each probe's 65,000 parts to ensure they met specifications, reported that while everything else checked out—the records' size, weight, composition, and magnetic properties—there was nothing in the blueprints about an inscription. The records were rejected. NASA prepared to substitute blank discs in their place. Only after Carl appealed to the NASA administrator, arguing that the inscription would be the sole example of human handwriting aboard, did we get a waiver permitting the records to fly.

Given the project's breakneck speed and the obstacles overcome, we watched the launch with relief as well as excitement, Carl embracing me and crying, "We did it! We did it!" as the Titan-Centaur rocket climbed into the clear blue sky on a pillar of smoke. The five of us were hugging one another as the rocket's rolling thunder reached the beaches. It was a great day—a beginning, but also an end. We were never all together again.

3. Voyager's Music

At the outset, I suggested two criteria to guide us in selecting the music: that we include a variety of music representing many cultures rather than just the one that had built and launched the spacecraft, and that we strive to make a "good" record.

Regarding the first stipulation, I'd say we did a defensible job of casting a wide net. The record includes both Eastern and Western classical music and "folk" music from places as disparate as Australia, Azerbaijan, Bulgaria, Benin, New Guinea, Peru, India, China, Japan, the Solomon Islands, and the Congo. In those days, before email and the internet, we had to obtain physical copies of every recording we listened to. Ann found the LP containing the raga "Jaat Kahan Ho" in a carton under a card table in the back of an appliance store. The folklorist Alan Lomax pulled a Russian recording, said to be the sole

copy of "Chakrulo" in North America, from a stack of lacquer demos and sailed it across the room to me like a Frisbee. We'd comb through all this music individually, and then meet and go over our nominees during long discussions that stretched into the night. It was exhausting, involving, utterly delightful work.

The second stipulation may seem a bit odd: With all the world's recorded music to choose from, how could we *not* wind up with a "good" record? What I meant was that we should resist compromise, selecting only music that moved us emotionally as well as intellectually. (As the musicologist Robert Brown put it, "If we don't send things we passionately care for, why send them at all?") A few politically motivated requests did crop up, among them a strange plea that we include a third-rate Russian nightclub standard on grounds that it might please the rulers of the Soviet Union. (We listened politely, then passed.) When we arrived at the Kennedy Space Center for the first Voyager launch, a NASA official confronted me to complain, "Damn it, Tim, how could a good Irish boy like yourself not put an Irish song on the record, knowing that Tip O'Neill is speaker of the House?" I was sorry to disappoint him, but one seldom succeeds at anything by trying to please everybody.

In selecting Western classical music, we sacrificed a measure of diversity to include three compositions by J.S. Bach and two by Ludwig van Beethoven. To understand why we did this, imagine the record being studied by extraterrestrials who lacked what we would call hearing, or whose hearing operated in a different frequency range than ours, or who hadn't any musical tradition at all. Even they could learn from the music by applying mathematics, which really does seem to be the universal language that music is sometimes said to be. They'd look for symmetries—repetitions, inversions, mirror images, and other self-similarities—within one composition or shared among two or more. (It would be quite natural for them to take this approach, given that all scientific laws are statements of symmetry.) We sought to facilitate the process by proffering Bach, whose works are full of symmetry, and Beethoven, who championed Bach's music and borrowed from it.

Their musical passions aside, the two composers were very different men.

Bach, the apotheosis of the Baroque, lived his life within a luminous sphere of Christian belief, dedicating his works to God and attributing his talent to God's grace. His performances alone would have made him a star in today's terms—people walked miles just to hear him tune a pipe organ—but Bach disliked calling attention to himself, preferring, as he put it in the dedication to his *Orgelbüchlein*, to devote his efforts "to the glory of the most high God, and that my neighbor may be benefited thereby."

Beethoven was born only 20 years after Bach's death but is viewed as heralding a modern, humanist era more attuned to rational inquiry than to faith and belief. He saw art's objectives as "freedom and progress" rather than celebration of the regnant deity. Beethoven's deathbed pronouncement, "*Plaudite, amici, comoedia finita est*" ("Applaud, oh friends, the comedy is over"), is hardly what Bach would have said in similar circumstances. The neatly bewigged Bach was in church every Sunday, whereas Beethoven seldom went to church and was so habitually wild-looking that he shares with Bob Dylan the distinction of having been picked up by the police as a vagrant while near the peak of his fame.

Yet Bach communicated a great deal to Beethoven. It was a one-way communication—like that of Homer and Shakespeare to us today, or the Voyager records' message to the putative inhabitants of other worlds—but it was highly effective for all that. Beethoven knew Bach's mathematics inside out. He studied Bach's *Well-Tempered Clavier* from age 11, belonged to a circle of Bach admirers who met to study the old master's works, and closed out Archduke Rudolph's celebrated all-night musical evenings by playing Bach on the piano, the consensus being that nothing could top that. The first movement of Beethoven's Fifth

Amahl Drake viewing candidate images for the record.


AMERICAN
OPTICAL

Symphony starts with a symmetrical translation, when the famous first four notes are repeated but shifted down in tone, and then takes the theme through mirror and rotation symmetries that eventually resolve into a four-note phrase that repeats the beginning without its shift in tone, da-da-da-*daaah* becoming da-da-da-*da*.

Beethoven's Cavatina might also reward mathematical analysis, but in all candor, it was included mainly because it's so moving. Beethoven could bring himself to tears just thinking about it. Its subjects are anguish and redemption; to what extent they resonate with extraterrestrials remains to be seen.

The records' Eastern classical selections arise from traditions older than those of the Western canon. "Flowing Streams" is part of a piece titled "Towering Mountains and Flowing Streams," attributed to Yu Po-ya around the seventh century B.C. The Japanese bamboo flute, or shakuhachi, is thought to have entered Japan via Egypt and China as early as the seventh century. It became popular in the 13th century, when it was taken up by Zen monks of the Fuke school. The India raga tradition goes back thousands of years and is said to have sprung from a spiritual conviction that music pervades the universe.

I'm often asked whether we quarreled over the selections. We didn't, really; it was all quite civil. With a world full of music to choose from, there was little reason to protest if one wonderful track was replaced by another wonderful track. I recall championing Blind Willie Johnson's "Dark Was the Night," which, if memory serves, everyone liked from the outset. Ann stumped for Chuck Berry's "Johnny B. Goode," a somewhat harder sell in that Carl initially called it "awful." But he soon came around on that one, going so far as to politely remind Lomax, who derided Berry's music as "adolescent," that Earth is home to many adolescents.

Rumors to the contrary, we did not strive to include the Beatles' "Here Comes the Sun," only to be disappointed when we couldn't clear the rights. We did consider that lovely track for a time but soon moved on. It's not the Beatles' strongest work, and the witticism of the title, if charming in the short run, seems unlikely to remain funny for a billion years.

While researching the selections for this release, David Pescovitz and Timothy Daly, with help from musicologists, anthropologists, and archivists around the world, discovered errors and omissions in the information provided us by recordists and record companies in 1977—some of which persisted into our book on the project, *Murmurs of Earth: The Voyager Interstellar Record* (Random House, 1978). Track three, listed by Lomax and in *Murmurs* as "Senegal Percussion," turns out instead to have been recorded in Benin and titled "Cengunmé." Track eight, previously identified only as "Men's House Song," now carries its proper title, "Mariuamangɨ," along with the performers' names. The panpipe musicians on Malaita, heard on a tape provided to Lomax by the Solomon Islands Broadcasting Corporation, have been identified, and tracks from Georgia, Peru, Mexico, and the Navajo Nation are now more fully and properly credited.

4. Sounds of Earth

The natural-sounds sequence is organized chronologically as an audio history of our planet and compressed logarithmically so the human story isn't limited to a little beep at the end. We mixed it on a 32-track analog tape recorder the size of a steamer trunk, a process so involved that Jimmy Iovine jokingly accused me of being "one of those guys who has to use every piece of equipment in the studio." With computerized boards still in the offing, the sequence's dozens of tracks had to be mixed manually. Ann, Jimmy, Columbia Records engineer Russ Payne, and I huddled over the board like battlefield surgeons, struggling to keep our arms from getting tangled as we rode the faders by hand and got it done on the fly.

The sequence begins with an audio realization of the "music of the spheres," in which the constantly changing orbital velocities of the planets Mercury, Venus, Earth, Mars, and Jupiter are translated into sound using equations derived in the 16th century by the astronomer Johannes Kepler. We then hear the volcanoes, earthquakes, thunderstorms, and bubbling mud of the early Earth. Wind, rain, and surf announces the advent of oceans, followed by living creatures—

from crickets, frogs, birds, and chimpanzees to wolves—and the footsteps, heartbeats, and laughter of early humans.

Sounds of fire, speech, tools, and the calls of wild dogs mark important steps in human advancement, as do those of sheepherding, blacksmithing, and woodworking. Morse code announces the dawn of modern communications—the telegraph having been the first technology capable of conveying information faster than a runner could deliver it. (The message being transmitted reads *"Ad astra per aspera,"* or "To the stars through hard work.") A brief sequence on modes of transportation runs from ships to jet airplanes to the launch of a Saturn V rocket.

The final sounds begin with a kiss, then a mother and child, then an EEG recording of (Ann's) brainwaves, and finally a pulsar—a rapidly spinning neutron star giving off radio noise—in a tip of the hat to the pulsar map etched into the record's protective case.

The sounds sequence has been criticized for depicting "good" aspects of the human condition, such as art and science, at the expense of "bad" aspects like war. I'm not unsympathetic toward this concern; we discussed it ourselves at the time. But the Voyager record is essentially an artifact of human culture, and cultures have more to do with the traits that make humans unique than with those we share with other species. Many terrestrial species are violent, but only one writes books and symphonies, builds libraries and concert halls, and sends robotic emissaries to other planets.

Some of our critics on this point may have been misled by the Eden myth—the notion that precivilized (that is, before cities) people were wonderfully peaceful, becoming violent only when exposed to property rights or some other allegedly corrupting influence. Popularized by the French philosopher J.J. Rousseau, the Eden myth has become dogma in certain ideological circles, but it fails to comport with the facts. The rise of civilization sharply reduced the incidence of human violence: The hideous specter of world wars notwithstanding, people today are far less likely to die violently than was the case prior to the rise of technology, science, and high culture. It would hardly be appropriate that a cultural artifact pay homage to the very forces that cultures discourage and attenuate.

Roger Payne's beautiful recordings of whale songs didn't fit into our rather anthropocentric sounds sequence but were so evocative that we wanted to include them somewhere. As we also had a collection of loquacious greetings from United Nations representatives, edited down and crossfaded to make them more listenable, I mixed the whales in with the diplomats. I'll leave it to the extraterrestrials to decide which species they prefer.

5. In Retrospect

Those of us involved in making the record assumed it would soon be commercially released, but that didn't happen. Carl repeatedly tried to interest record labels in the project, only to run afoul of what he termed, in a letter to me dated September 6, 1990, "internecine warfare in the record industry." The problem, he said, was that record company executives didn't want "their" recordings turning up on another label.

As a result, nobody heard the whole thing properly from the night in 1977 when I walked out of the studio with the record under my arm until the morning in 2016 when we mounted the master tape, crossed our fingers, and hit play. (Much of what *had* been heard, on internet snippets and in a short-lived commercial CD release made in 1992 without my participation, came from a set of 7.5-inch-per-second, quarter-track analog tape dubs that I'd distributed to our team as keepsakes.) It was exciting to hear how good the record still sounds. Were Carl alive today—he died in 1996, at age 62, at the Fred Hutchinson Cancer Research Center in Seattle—I think he'd be delighted.

Carl and Frank may have backed into the concept, by way of asking how they could get more data onto a plaque and coming up with the phonograph record idea, but I'm glad we sent music, which may have been the original art form and which the ancient Greeks named for the nine goddesses (the Muses) who inspired all the arts. Art reflects what I take to be the universal condition of thinking beings everywhere—that of fashioning local order out of a broader chaos, seeking perfection but finding it nowhere. Human art is said to arise from our forebodings of death, but they in turn are a subset of the broader truth that nothing that exists is perfect or will last forever. Quantum physics and mathematics alike indicate that no conclusion about the foundations of things can be utterly complete and true. Cosmology confirms that neither we nor the smartest beings in the universe can ever know more than a small—perhaps infinitesimal—fraction of all that's going on out there. If art is a matter of creating original, involving works in the face of predictably imperfect outcomes, art will be found wherever intelligence is found. Perhaps we all sing our songs as best we can, proffering them against the wider darkness that surrounds all our campfires. Music is not a message, but the gesture of sending music may well be.

Voyager mission project manager John Casani with the Voyager record, its cover, and a small American flag to be carried by the spacecraft.


ENERAL DYNAMICS
Convair Division
ARRIVE ALIVE


n2 78/100
18
1/100
o2 21/100
h2o 1/100
co2 3/10000
1/300 cm
22982400 s
266d
2 cm
TRANS ANTARCTIC EXPEDITION
305 m

PICTURES FROM EARTH

"One does not meet oneself until one catches the reflection from an eye other than human," wrote the anthropologist and philosopher Loren Eiseley.

This was Jon Lomberg's mindset as he and Frank Drake, Amahl Shakhashiri Drake, and Wendy Gradison, Carl Sagan's editorial assistant, set about curating a gallery of images that would represent Earth for those who have never visited it.

Led by Drake, the Voyager record's photo group agreed from the outset to avoid depictions of war, crime, poverty, and disease. It was a conscious decision that the interstellar message could reflect only positively on our planet.

Over just three intense weeks, the team scoured libraries, drafted explanatory diagrams, staged photo shoots, and flipped through two decades' worth of *National Geographic* magazines. The result is a gallery that begins by orienting the viewer and moves into an exposition of the human life cycle. From there, it becomes a survey of Earth's changing landscapes, a necessarily limited glimpse of our planet's flora and fauna, and photo essays on daily life, our built environment—from homes to trains to the Taj Mahal—and some of the cultures we've created.

Many images contain recurring themes or subjects meant to illuminate connections among the pictures. Lomberg inked silhouettes of several photographs to help focus the viewer's attention on certain elements in each image. In one case, Lomberg's drawing is all that remains. NASA vetoed a photograph of a naked man and pregnant woman holding hands, likely concerned about the same prudish reaction stirred up by the nude drawings on the Pioneer plaques. As the committee felt the content of the image was essential to the visual story of human reproduction, they kept the silhouette of the nudes in the sequence.

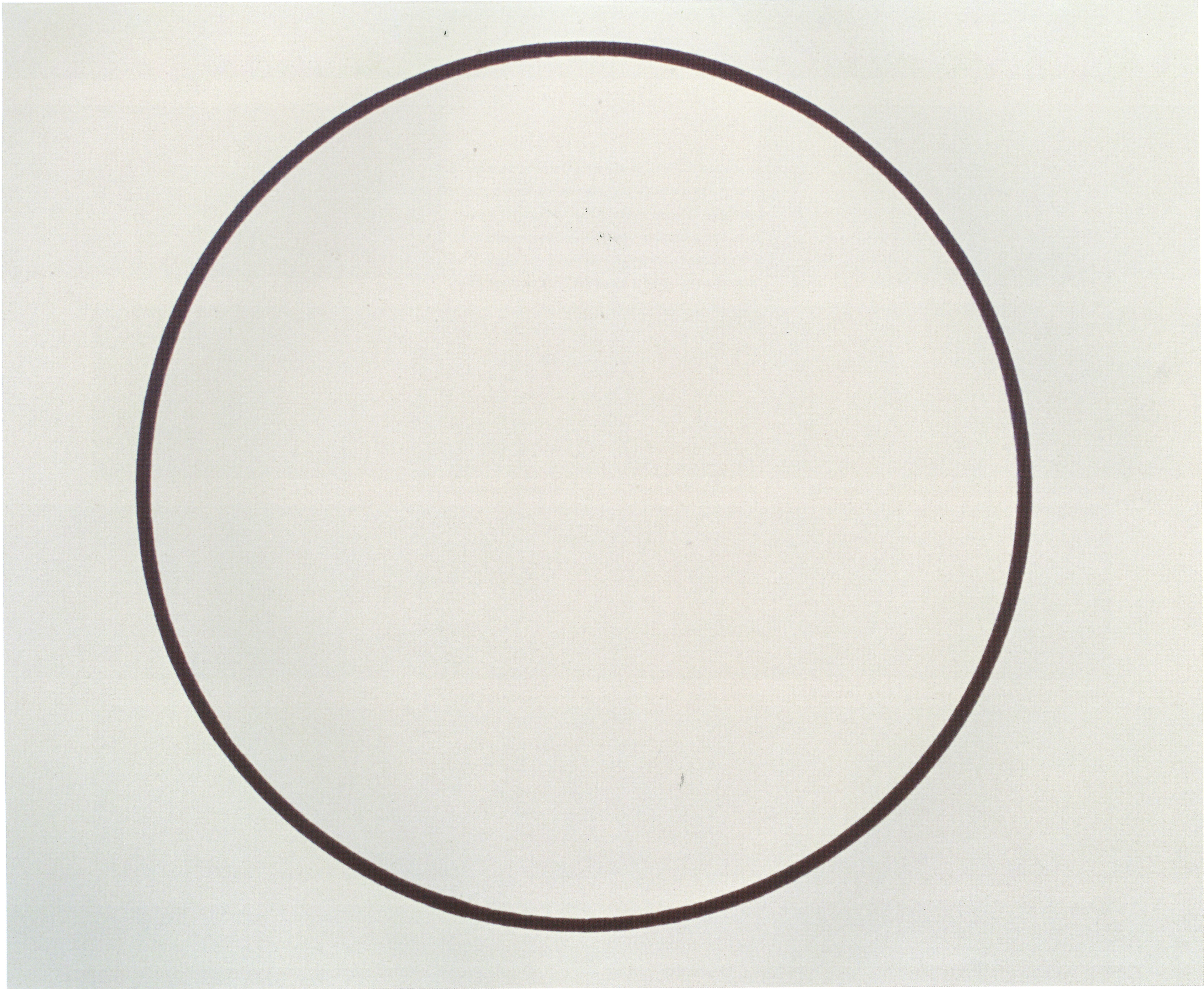
No captions were included. After all, nobody expected the extraterrestrials to read English. At the last minute, however, five images of text were added. President Jimmy Carter's decision to contribute a written message to the record prompted NASA officials to insist that the project must also honor the U.S. senators and representatives who supported the space agency's activities. Their names were typed out and the lists photographed along with the presidential message.

Frank Drake had always planned to encode the photos in the audio spectrum for the record. The challenge was finding technology capable of the task. While flipping through an electronics catalog, Valentin Boriakoff, Drake's colleague at the National Astronomy and Ionosphere Center, stumbled upon Colorado Video, a small television equipment firm in Boulder that had built a unique device for encoding television images as audio signals that could be transmitted over telephone lines.

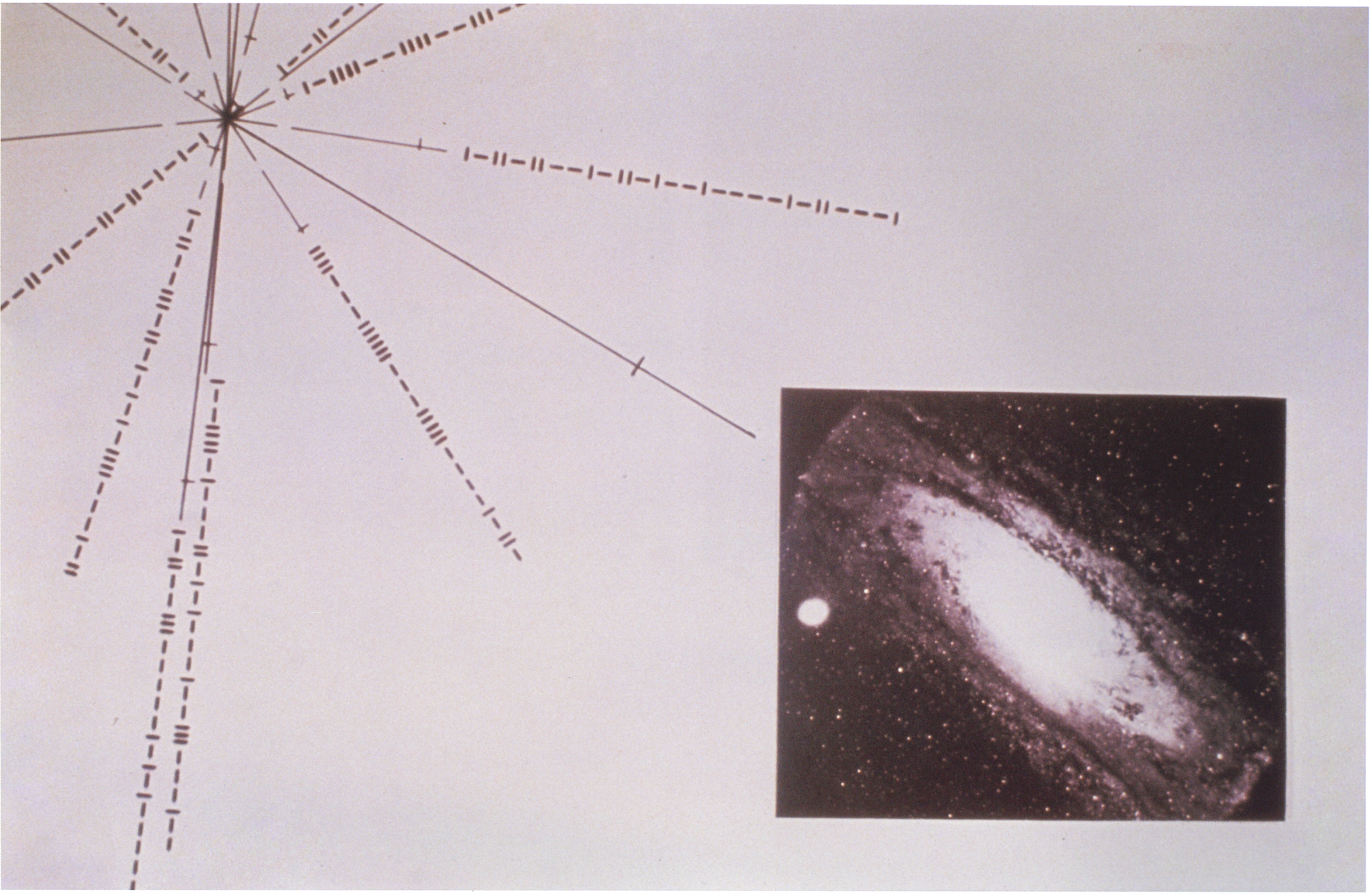
Donating their time and expertise to the project, engineers at Colorado Video projected each Voyager slide onto a television camera lens, generating a signal that their machine converted into several seconds of sound per photo. Due to the record's space constraints, the engineers encoded the images in grayscale at a resolution of 240 by 512 "picture elements" (light and dark areas), except for 20 photos the committee felt required color to communicate their meaning or aesthetic intent. Those were encoded three times, with slightly different levels of gray meant to represent color separations (red, blue, and green), which would combine into the full-color original.

The following pages contain the complete set of images on the Voyager Interstellar Record. They were scanned from the original slides prepared in 1977 and held in Frank Drake's archives ever since.

The golden record's photo sequence is a visual time capsule of Earth. It may be only a snapshot of our planet's story, but it's a memorable one.

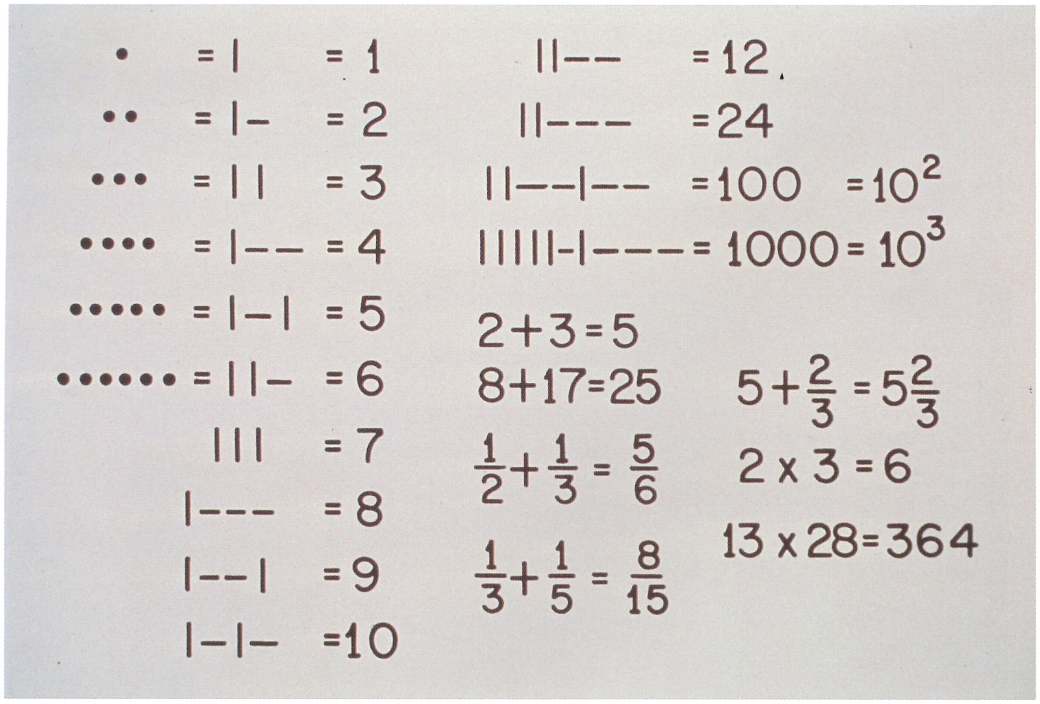


1.

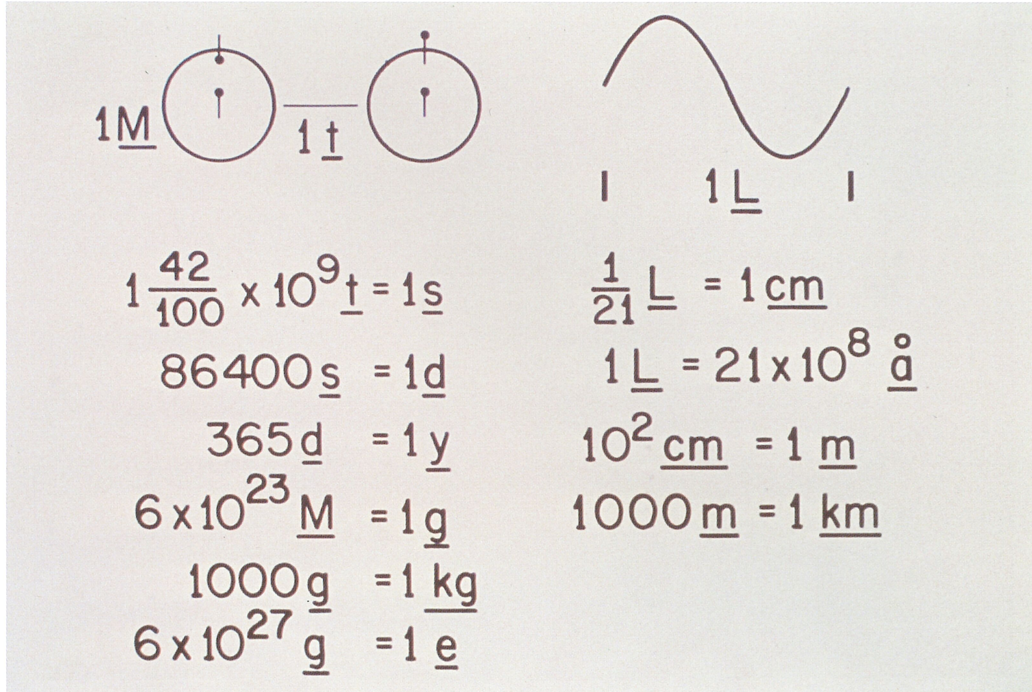


2.

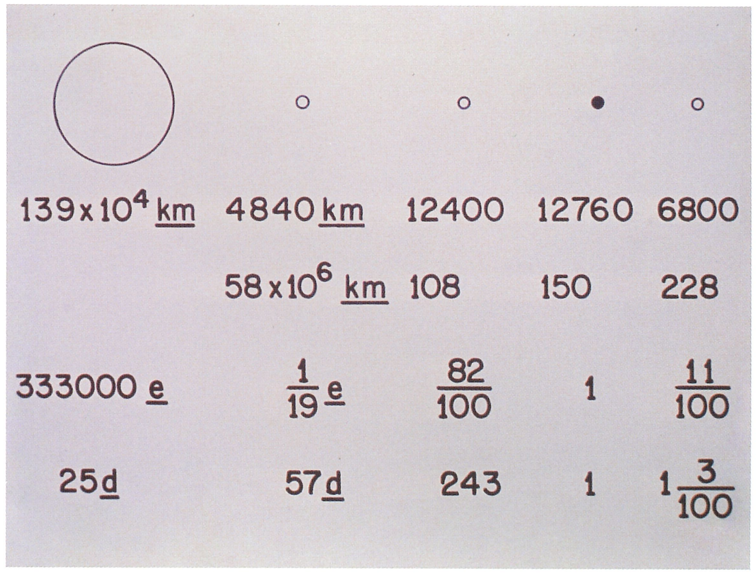
1. *Calibration circle (Jon Lomberg)*
2. *Pulsar map with the Andromeda galaxy as a landmark (Frank Drake)*


• = I = 1
•• = I– = 2
••• = II = 3
•••• = I–– = 4
••••• = I–I = 5
•••••• = II– = 6
III = 7
I––– = 8
I––I = 9
I–I– = 10
II–– = 12
II––– = 24
II––I–– = 100 = 10²
IIIII–I–––– = 1000 = 10³
2+3=5
8+17=25
1/2 + 1/3 = 5/6
1/3 + 1/5 = 8/15
5 + 2/3 = 5 2/3
2 x 3 = 6
13 x 28 = 364

3.


1M
1t
1L
1 42/100 x 10⁹ t = 1s
86400 s = 1d
365 d = 1y
6 x 10²³ M = 1g
1000 g = 1 kg
6 x 10²⁷ g = 1 e
1/21 L = 1 cm
1 L = 21 x 10⁸ å
10² cm = 1 m
1000 m = 1 km

4.



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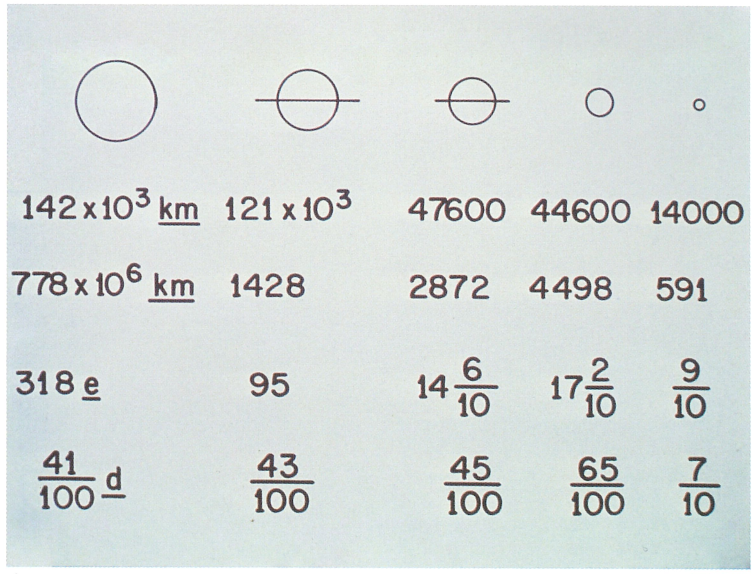

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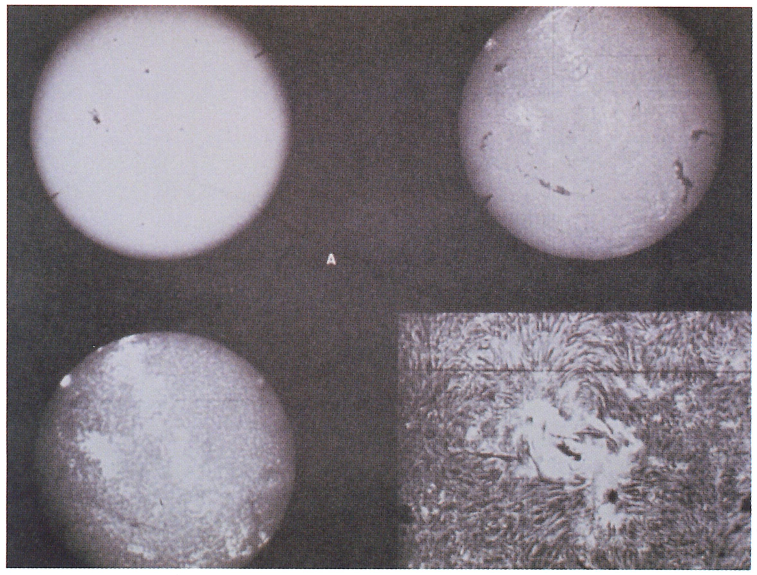
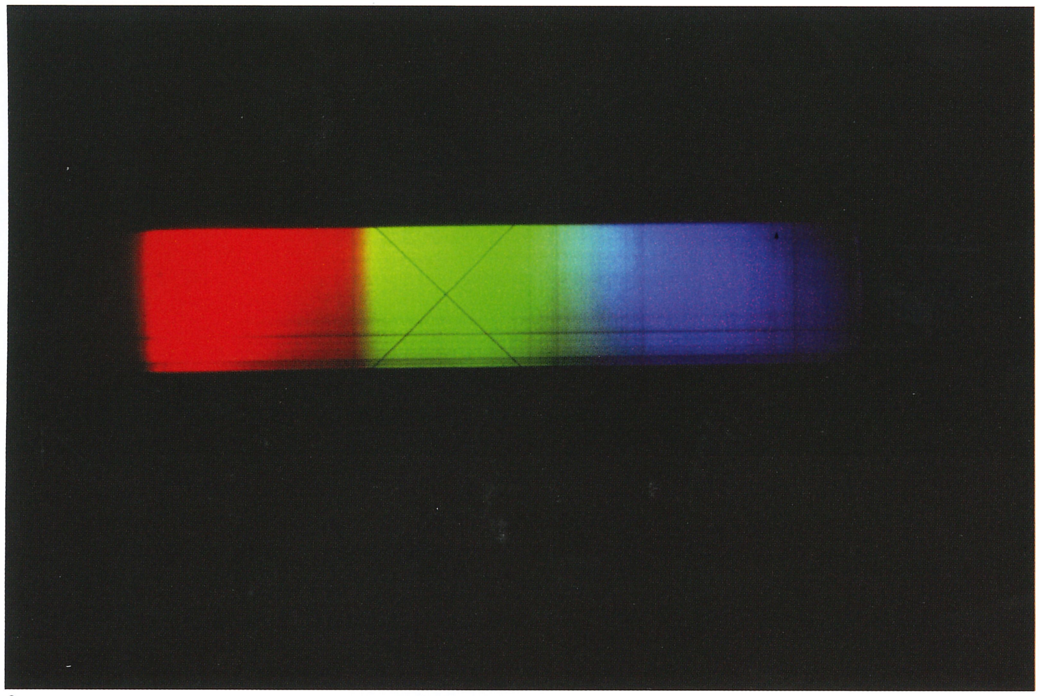


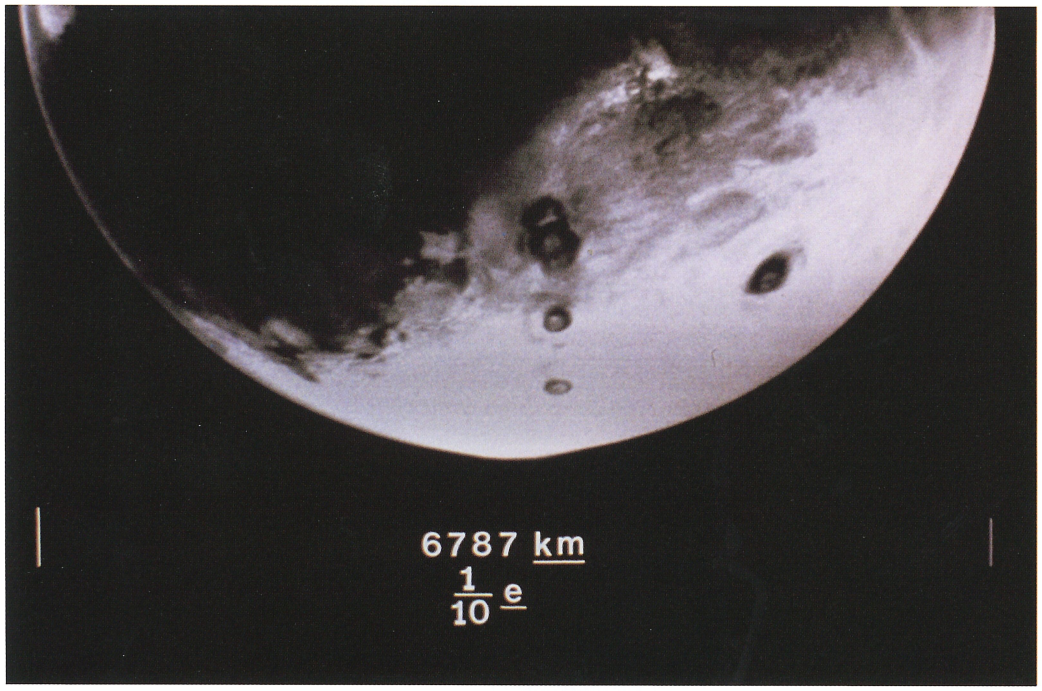
7.

3. Definitions of mathematical notation (Frank Drake)
4. Definitions of physical units of measurement (Frank Drake)
5–6. Solar system with planetary measurements (Frank Drake)
7. The sun (Hale Telescope)



8.

9.



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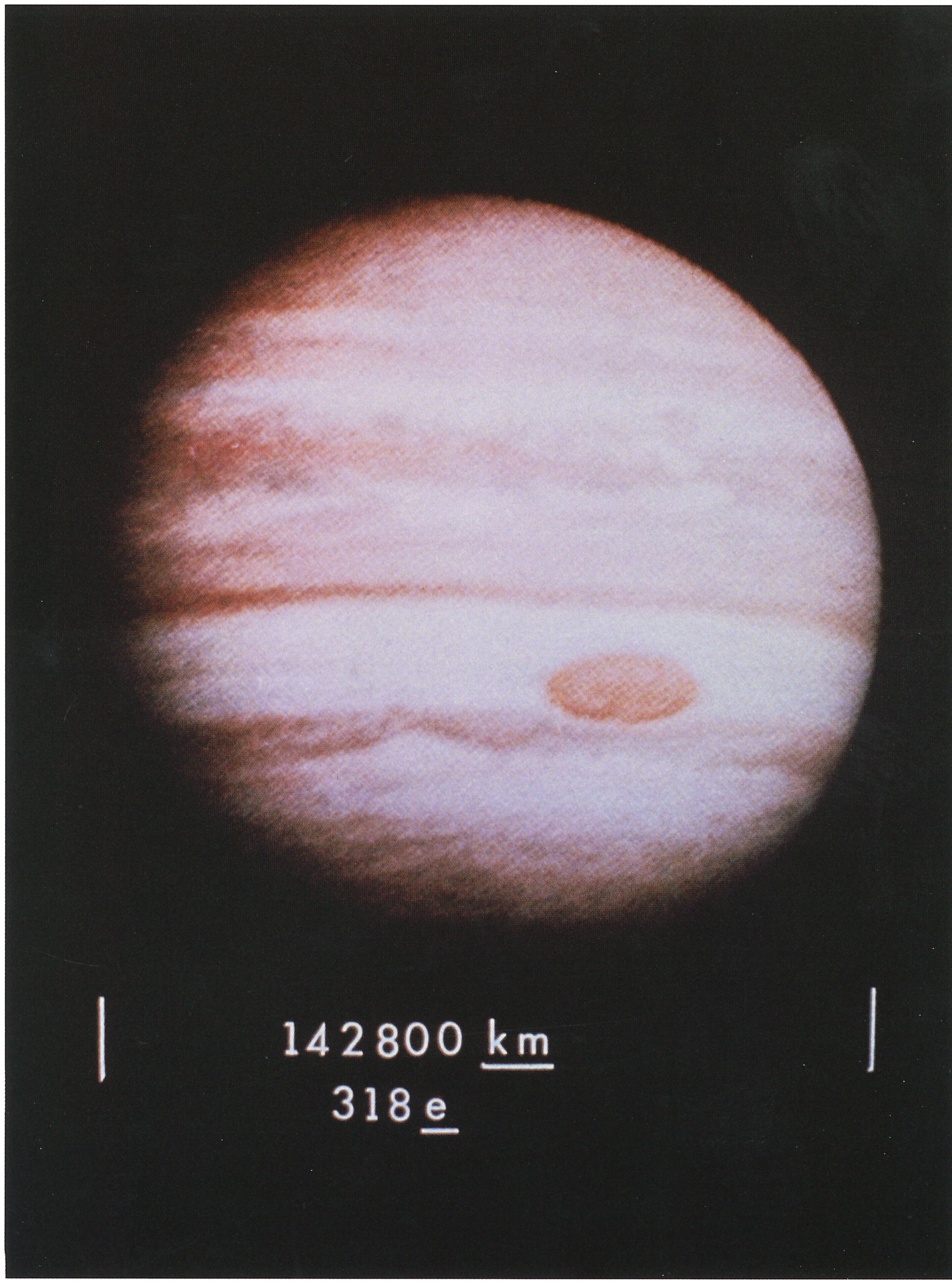

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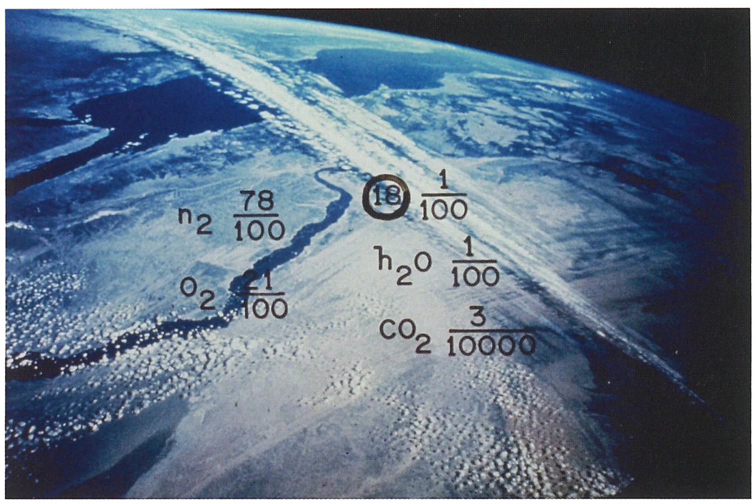
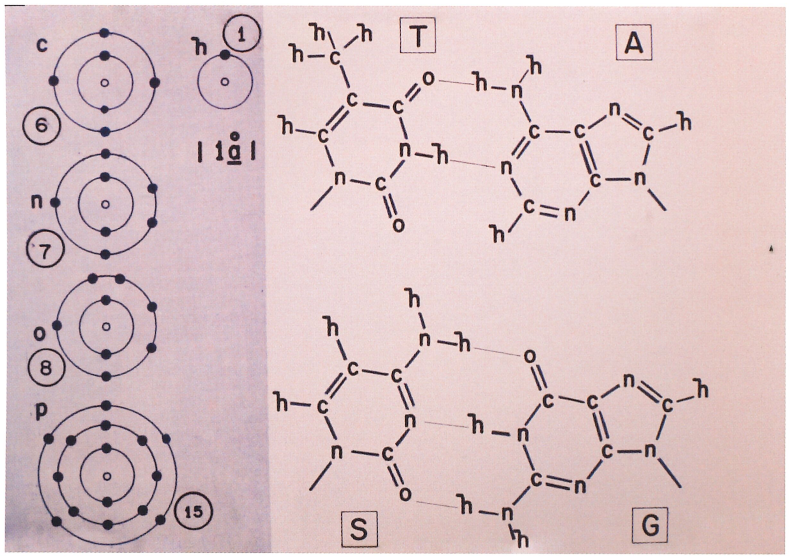


13.

8. Solar spectrum (Valentin Boriakoff and Dan Mitler)
9. Mercury (NASA)
10. Mars (NASA)
11. Jupiter (NASA)
12. Earth (NASA)
13. Egypt, the Red Sea, the Sinai Peninsula, and the Nile with the composition of Earth's atmosphere (NASA)



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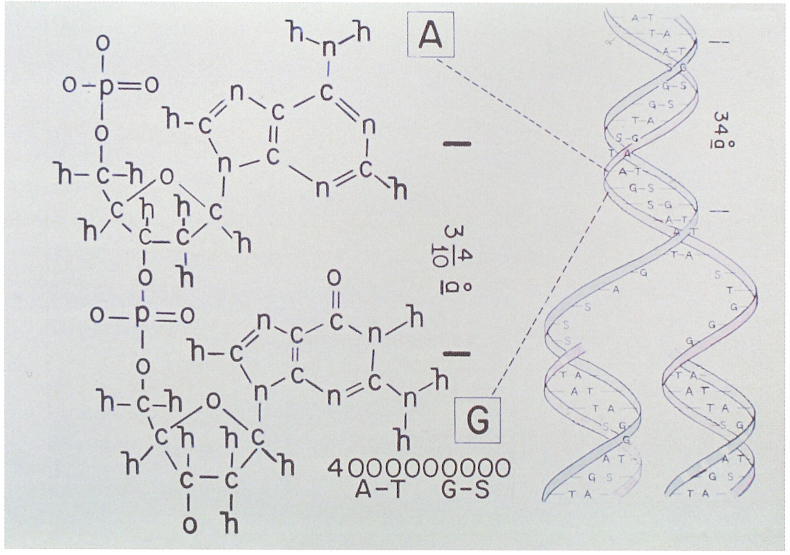

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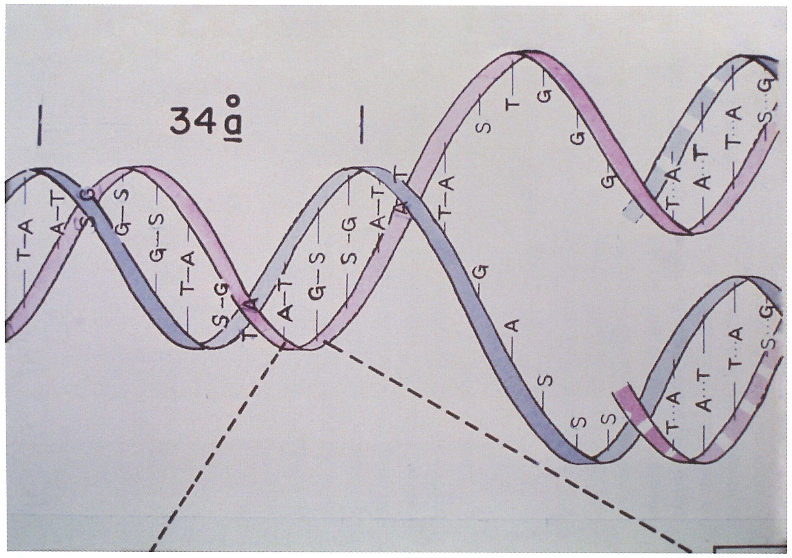

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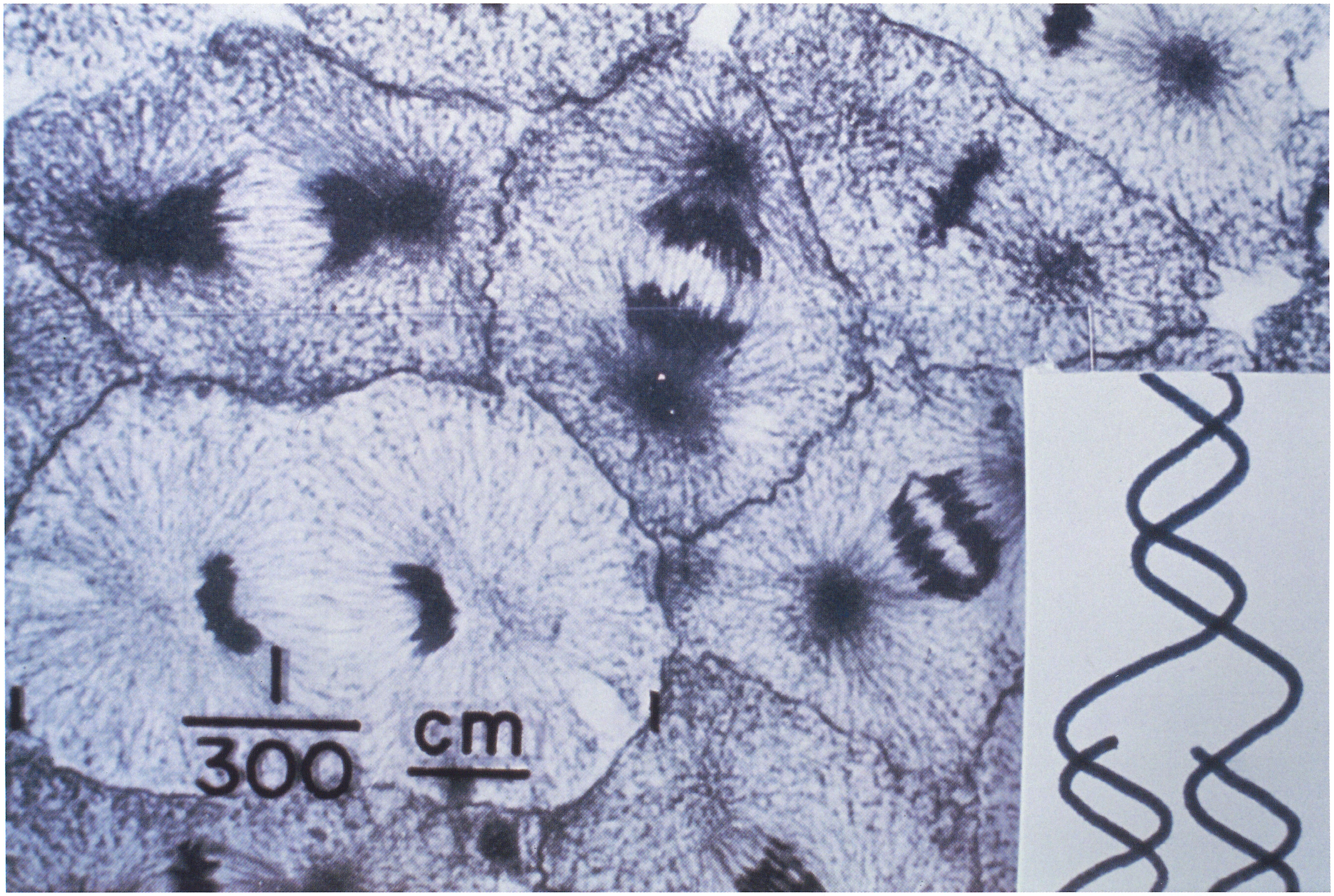
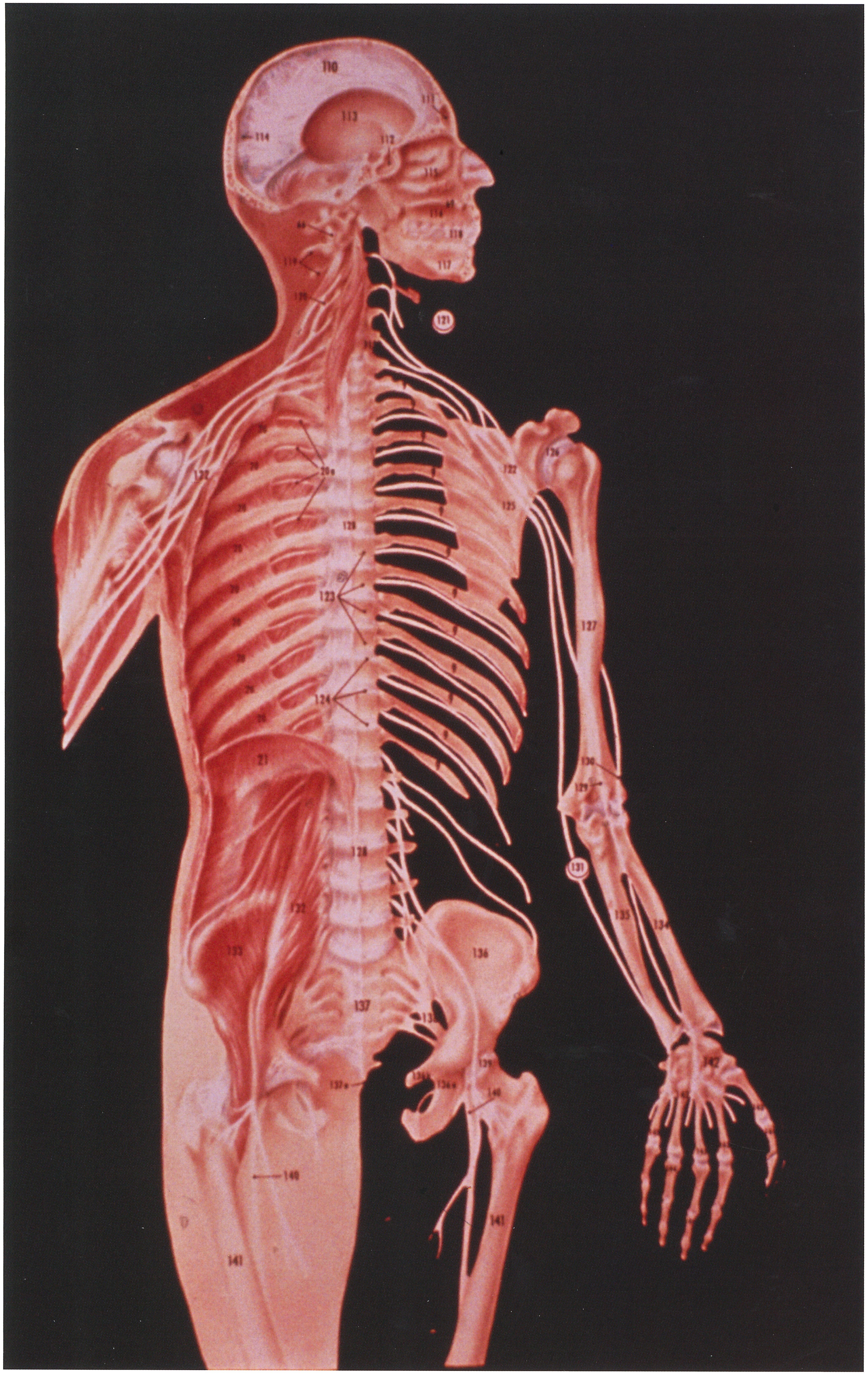


17.

14–16. DNA structure and replication
(Jon Lomberg)
17. Cell division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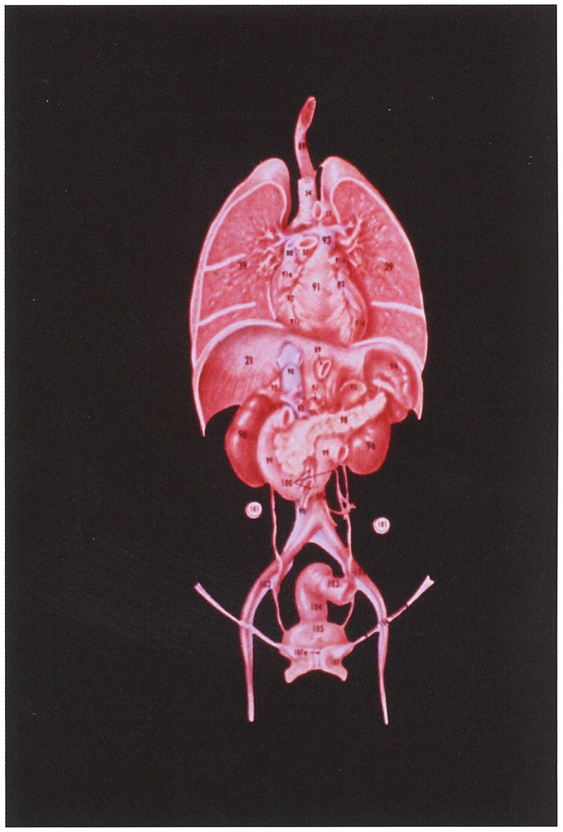

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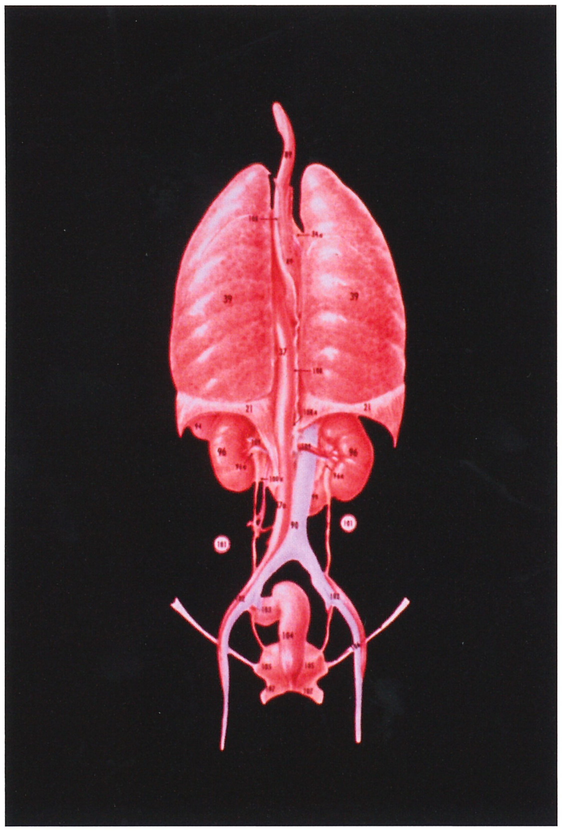

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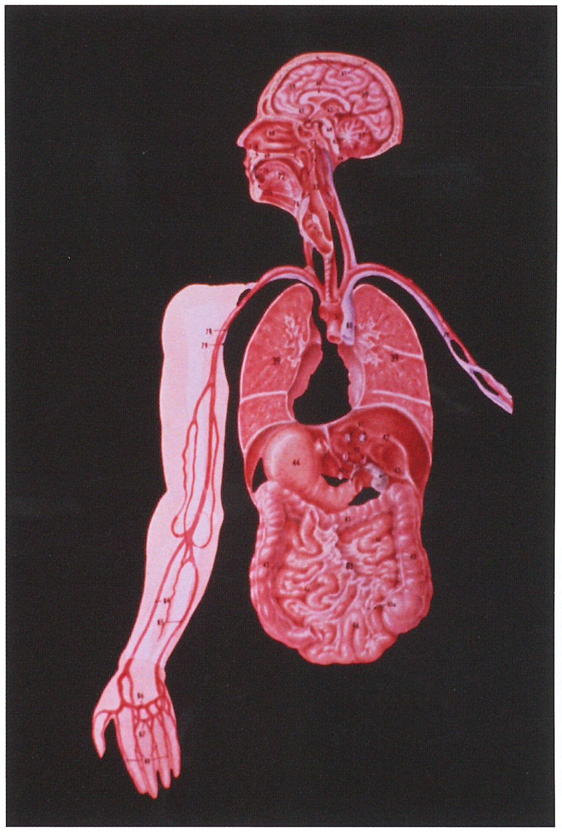

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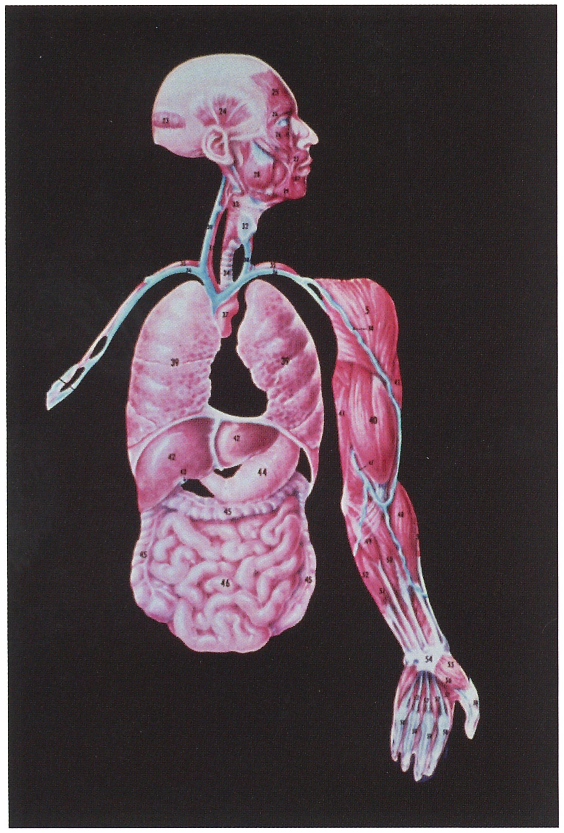

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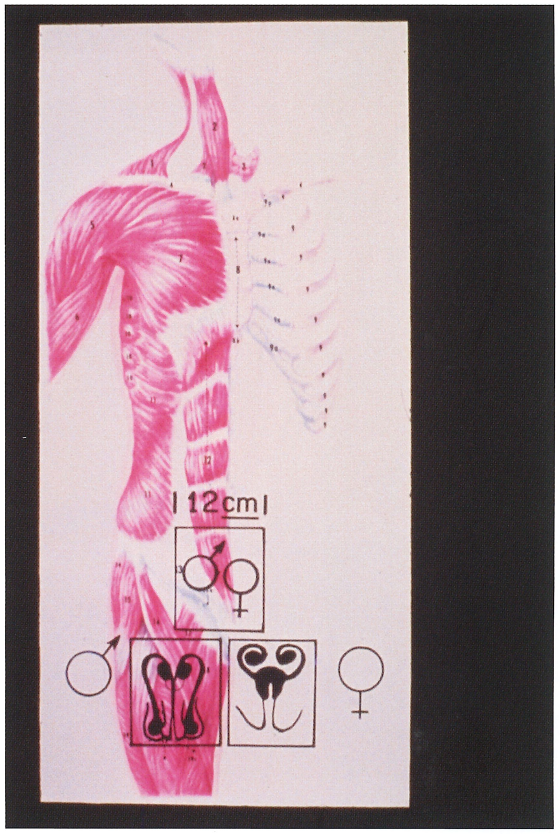
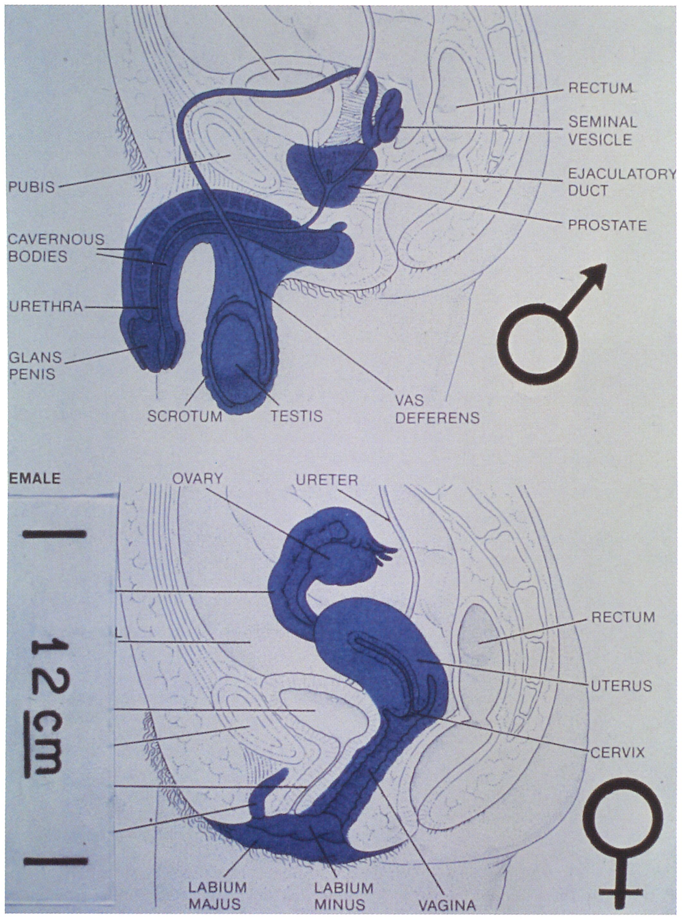
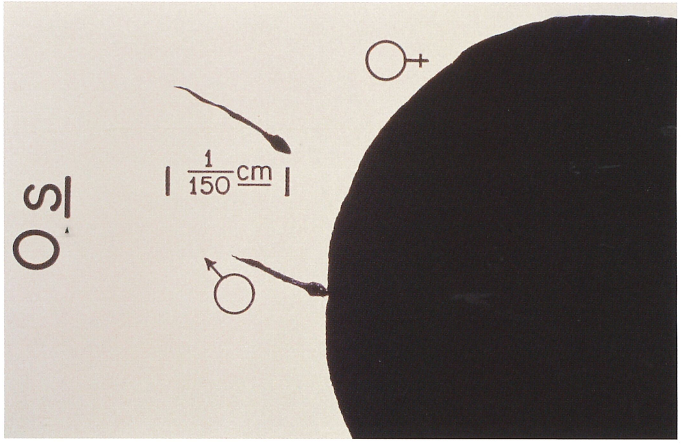


25.

18–25. Human anatomy


RECTUM
SEMINAL VESICLE
EJACULATORY DUCT
PUBIS
PROSTATE
CAVERNOUS BODIES
URETHRA
GLANS PENIS
SCROTUM
TESTIS
VAS DEFERENS
♂
EMALE
OVARY
URETER
RECTUM
UTERUS
CERVIX
12 cm
LABIUM MAJUS
LABIUM MINUS
VAGINA
♀

26.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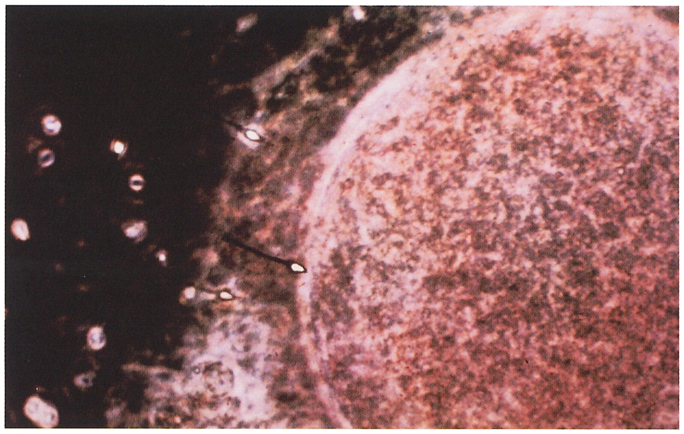
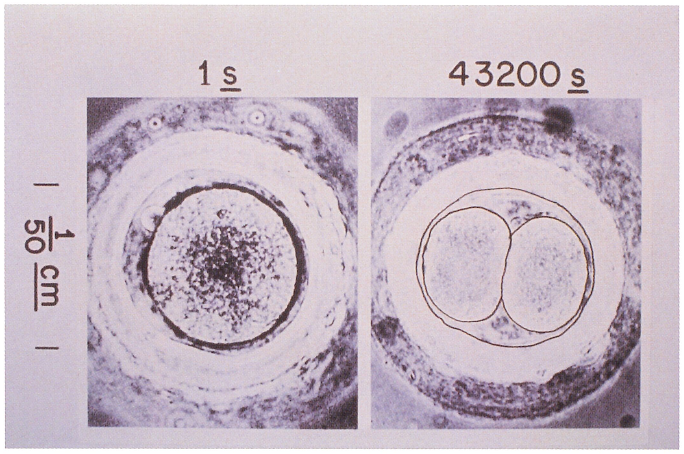
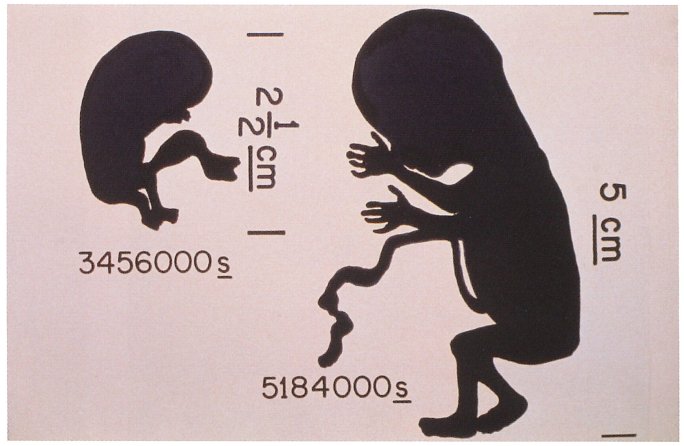


28.

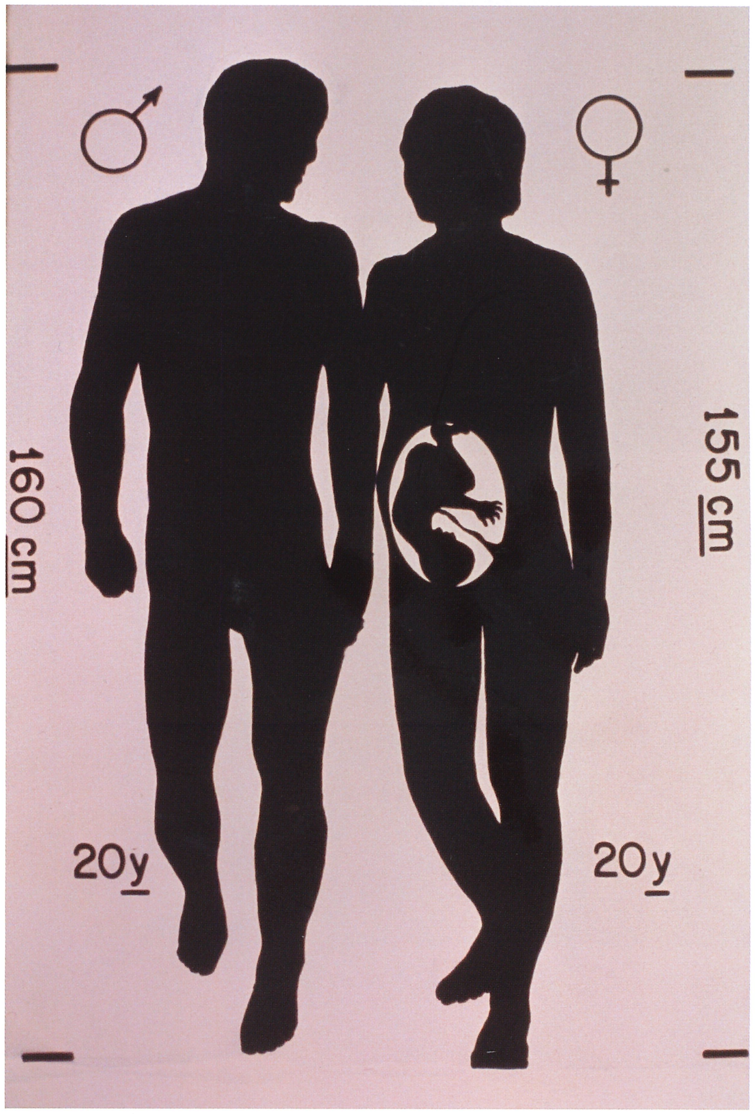

1 s
43200 s
1/50 cm

29.


2 1/2 cm
3456000 s
5 cm
5184000 s

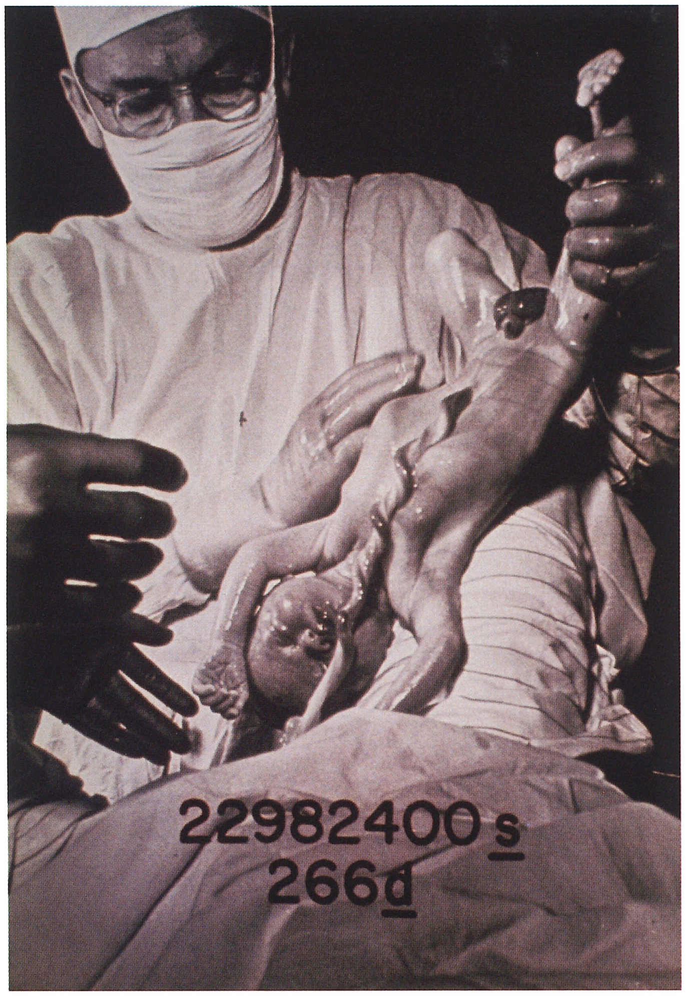
30.

31.



32.

26. Diagram of human sex organs (Sarah Landry)
27. Conception silhouette (Jon Lomberg)
28. Conception (Lennart Nilsson)
29. Fertilized ovum (Lennart Nilsson)
30. Fetus silhouette (Jon Lomberg)
31. Fetus (Frank Allan)
32. Silhouette of male and female (Jon Lomberg)



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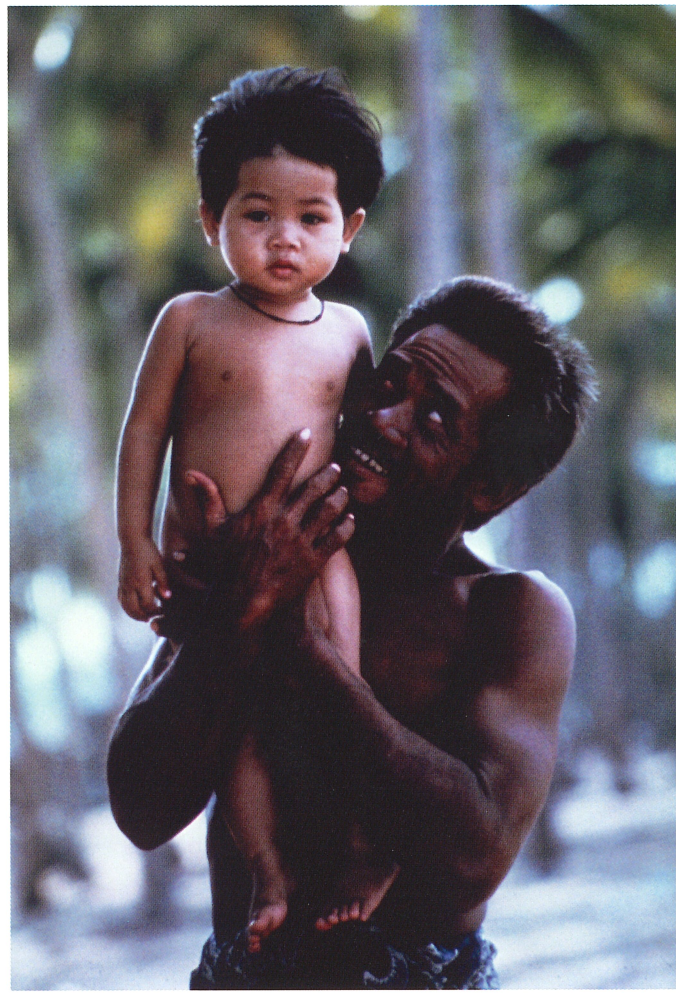

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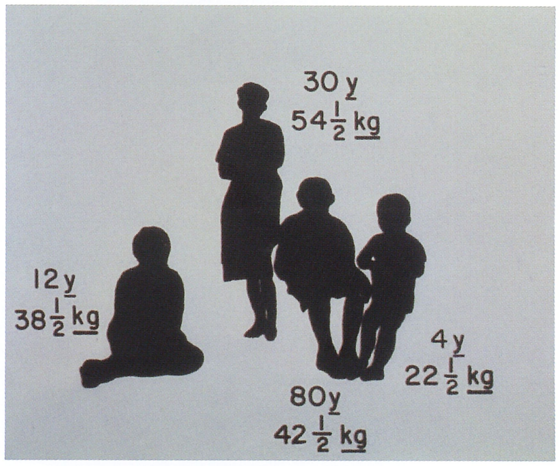
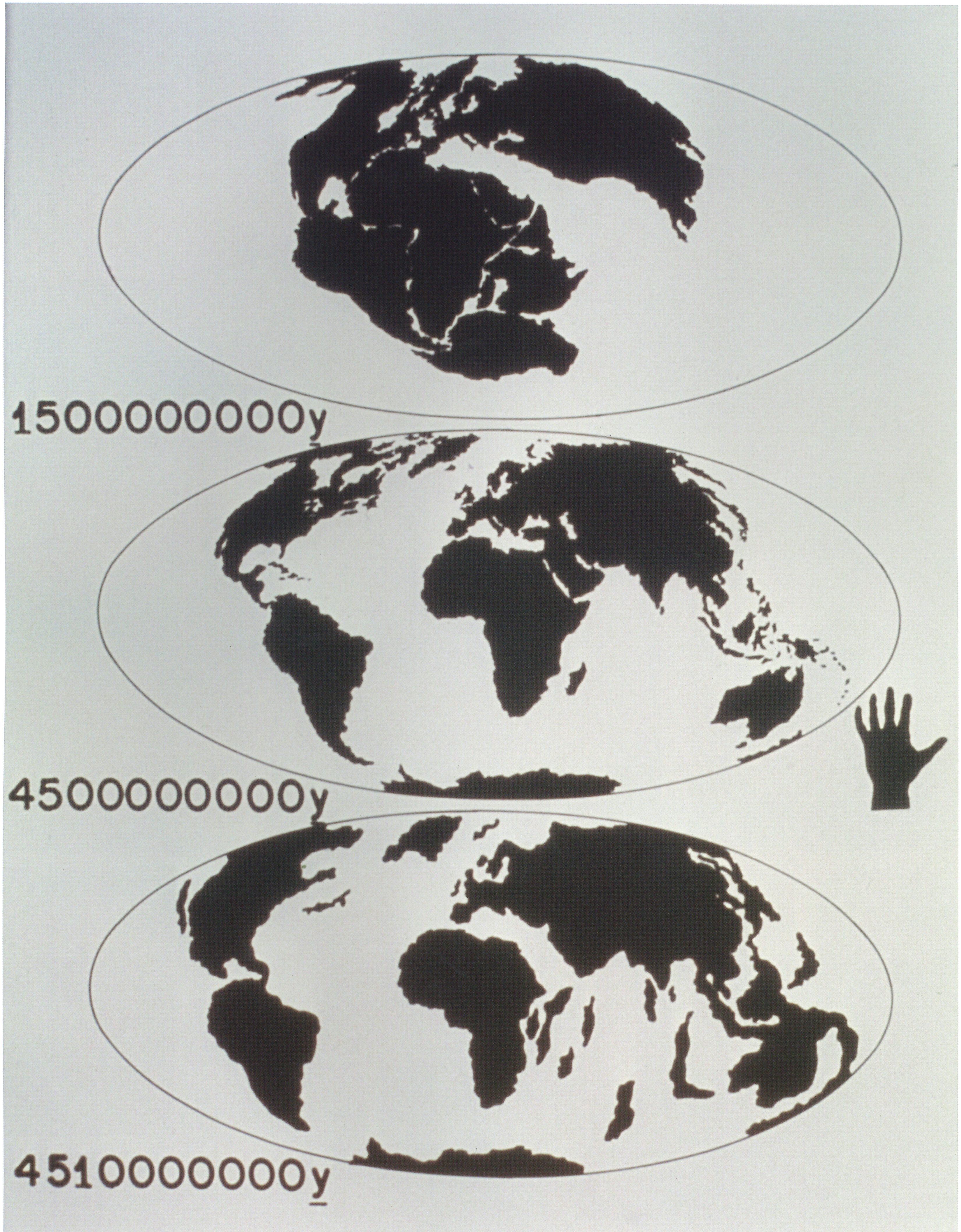


37.

38.

33. Birth (Wayne Miller)
34. Nursing mother (United Nations)
35. Malaysian man and his daughter (David Alan Harvey)
36. Group of children at the United Nations International School (Ruby Mera)
37. Family portrait silhouette (Jon Lomberg)
38. Family portrait (Nina Leen)



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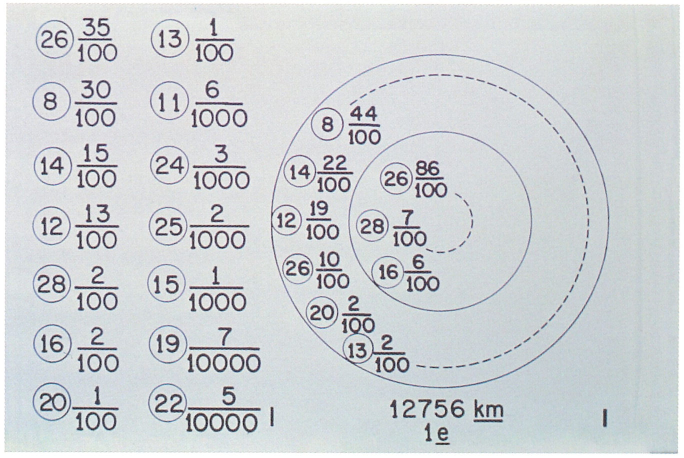

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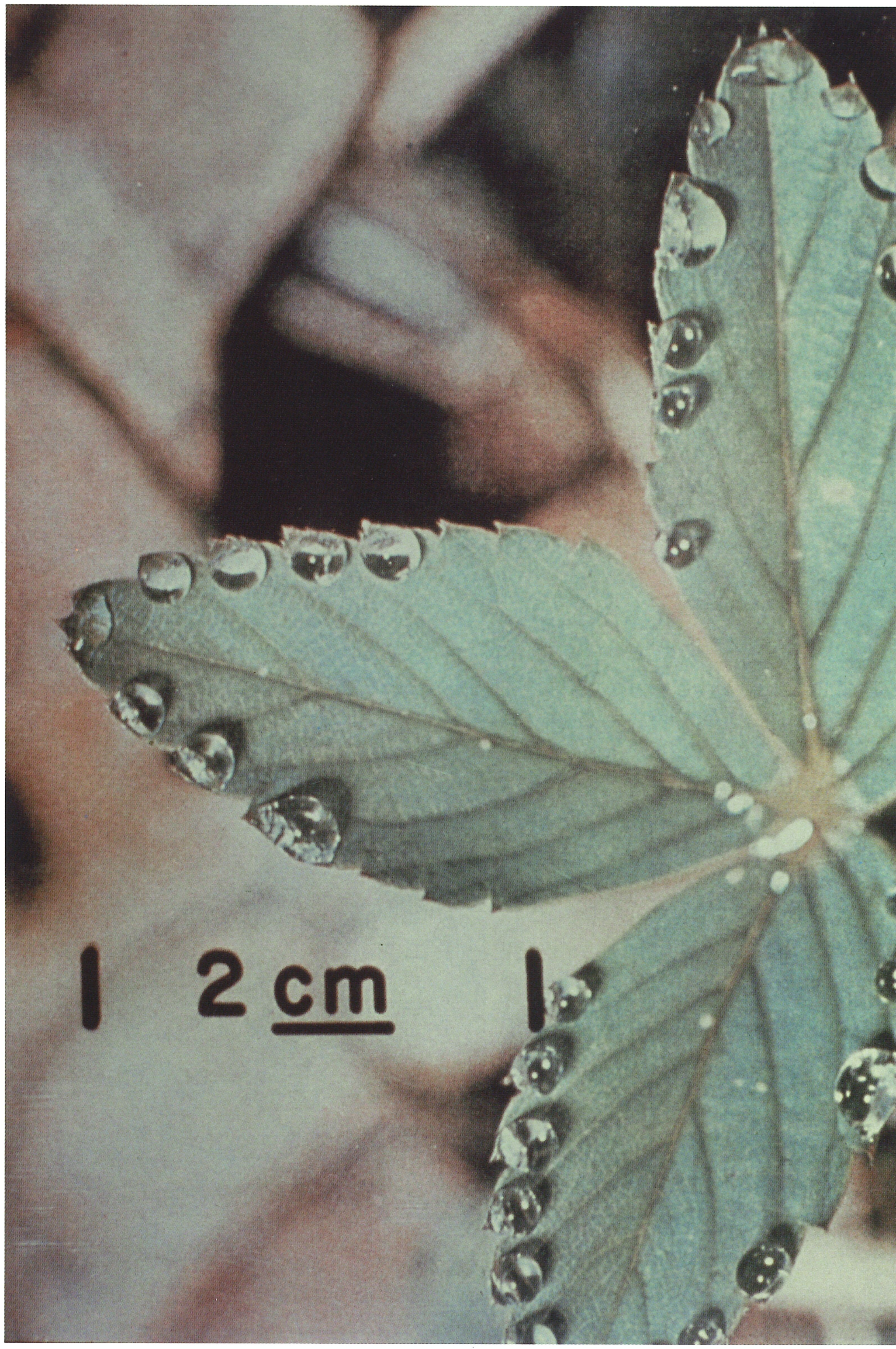
45.

39. Diagram of continental drift (Jon Lomberg)
40. Structure of the Earth with abundance of elements (Jon Lomberg with Steven Soter)
41. Heron Island (Jay M. Pasachoff)
42. Cape Neddick, Maine (Dick Smith)
43. The Tetons and the Snake River, Wyoming (Ansel Adams)
44. A horseman and his dog cross the desert, Pisco, Peru (George Mobley)
45. Monument Valley, Arizona (Ray Manley)

46.



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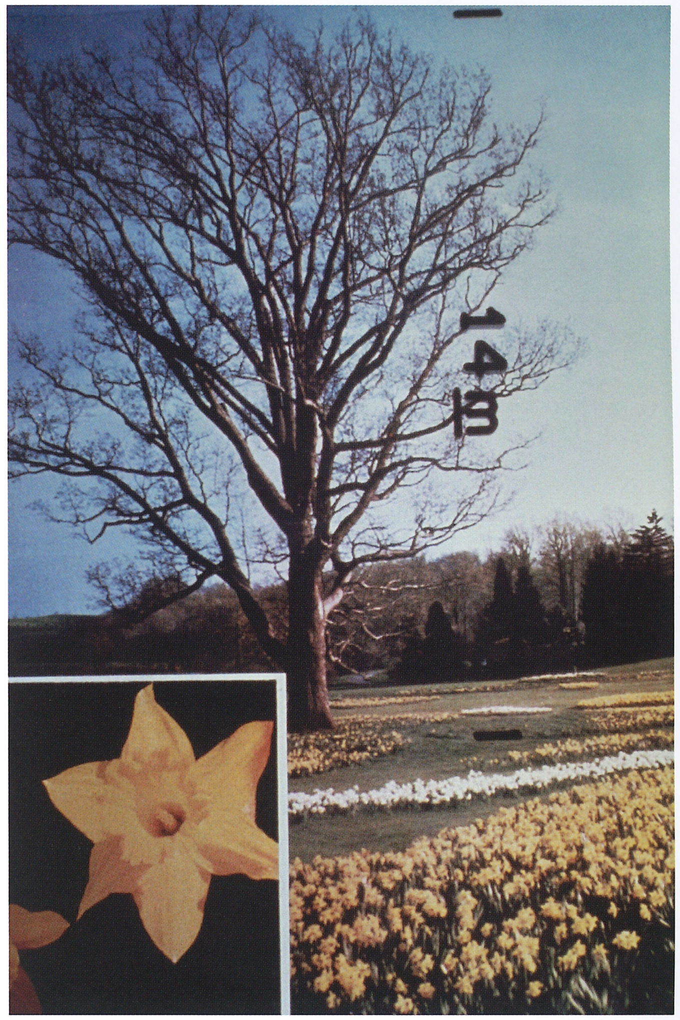
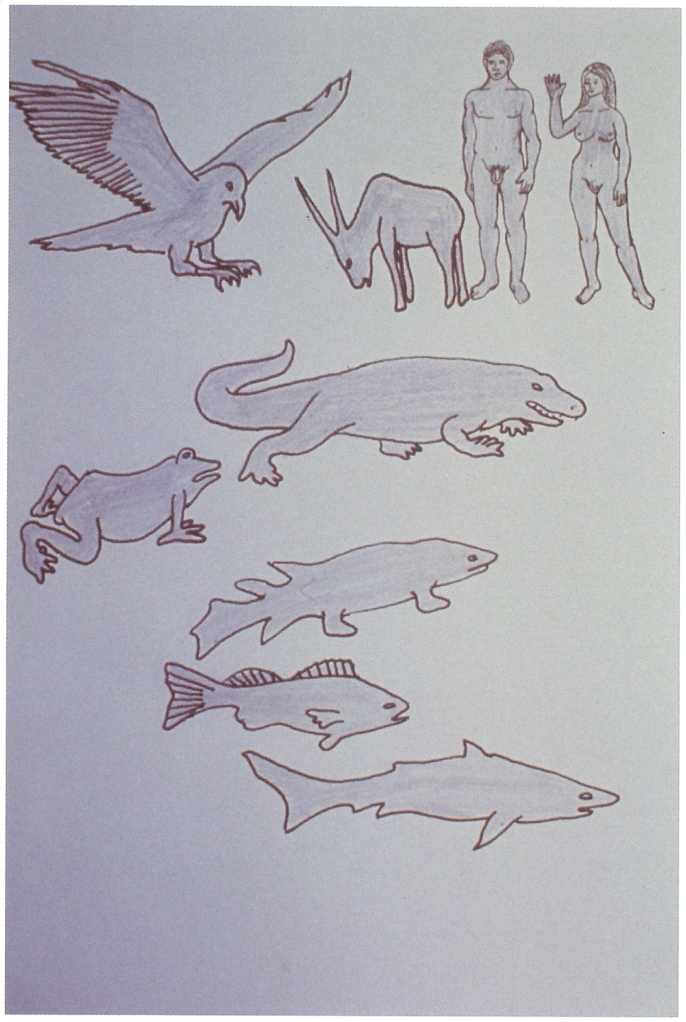


50.

46. Forest scene with mushrooms, Petersburg, Virginia (Bruce Dale)
47. Strawberry leaf (J. Arthur Herrick)
48. Fallen leaves, White Sulphur Springs, West Virginia (Jodi Cobb)
49. Sequoia and snowflake (Josef Muench/Robert Sisson)
50. Tree and daffodils (Gottlieb Hampfler)

51.



52.

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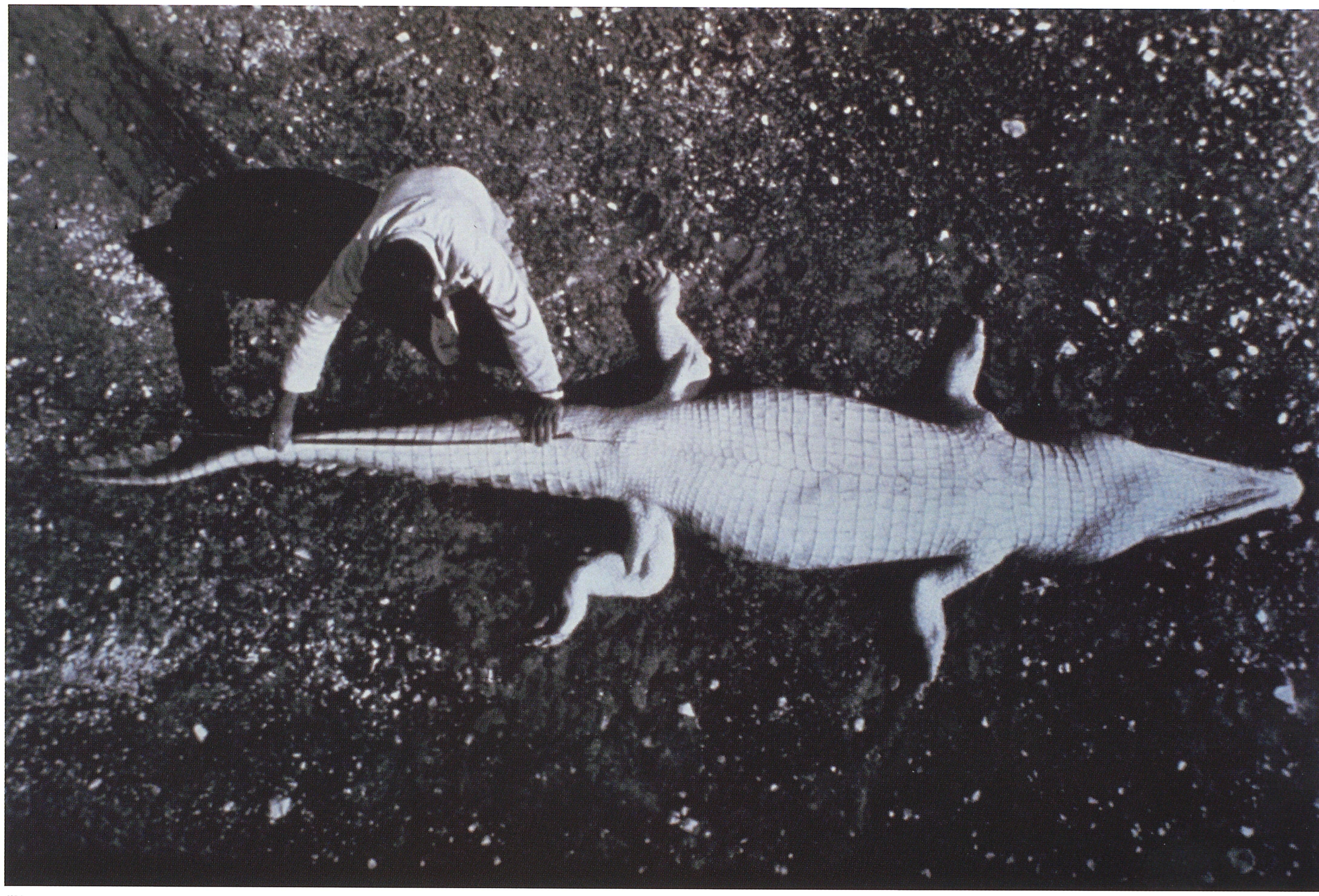
55.

51. *Ichneumon fly (Stephen Dalton)*
52. *Diagram of vertebrate evolution (Jon Lomberg)*
53. *Turbinellidae seashell (Hermann Landshoff)*
54. *Dolphins (Thomas Nebbia)*
55. *Sweeper fish and diver in the Red Sea (David Doubilet)*

56.



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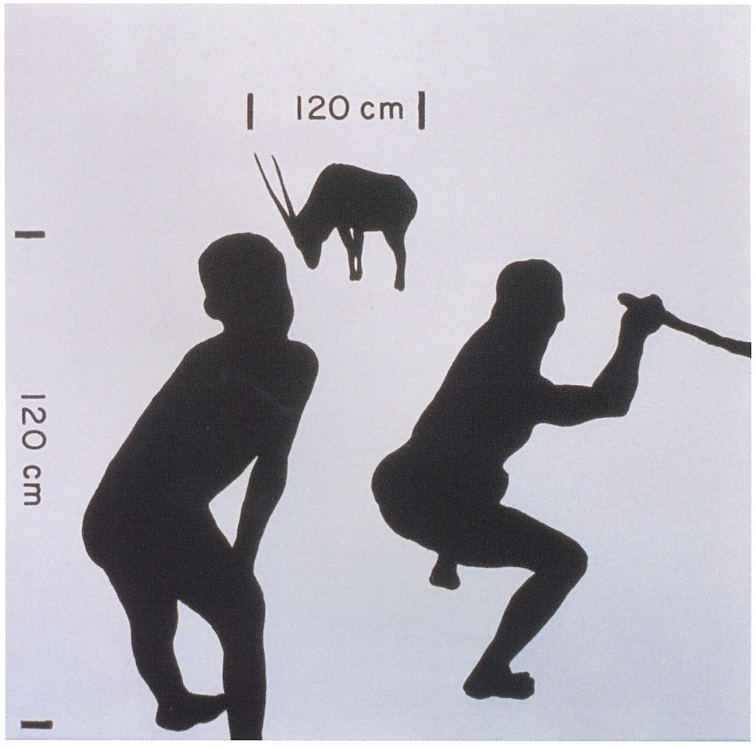

61.

62.

56. Tree toad (David Wickstrom)
57. Crocodile in Alia Bay, Lake Rudolf, Kenya (Peter Beard)
58. Short-toed eagle, Doñana National Park, Spain (José Ramón Pons)
59. Watering hole (South African Tourism)
60. Jane Goodall observing chimpanzees, Gombe Stream National Park, Tanzania (Vanne Morris-Goodall)
61. Bushmen hunters in Botswana silhouette (Jon Lomberg)
62. Bushmen hunters in Botswana (Nat Farbman)


63.


64.


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63. Man from Nicaragua (Yutaka Nagata)
64. Dancer from Bali (Donna Grosvenor)
65. Women in Santiago Atitlán, Guatemala (Joe Schershel)
66. Craftsman carving elephants from teak, Chiang Mai, Thailand (Dean Conger)
67. Elephant, Mae Sariang, Thailand (Peter Kunstadter)
68. Elderly farmer from Cappadocia, Turkey (Jonathan Blair)
69. Man searching for herbs in Owen County, Indiana (Bruce Baumann)

70.

71.

70. *Gaston Rébuffat atop Aiguille de Roc, Mont Blanc massif, France (Georges Tairraz)*
71. *Gymnast Cathy Rigby (Phillip Leonian)*

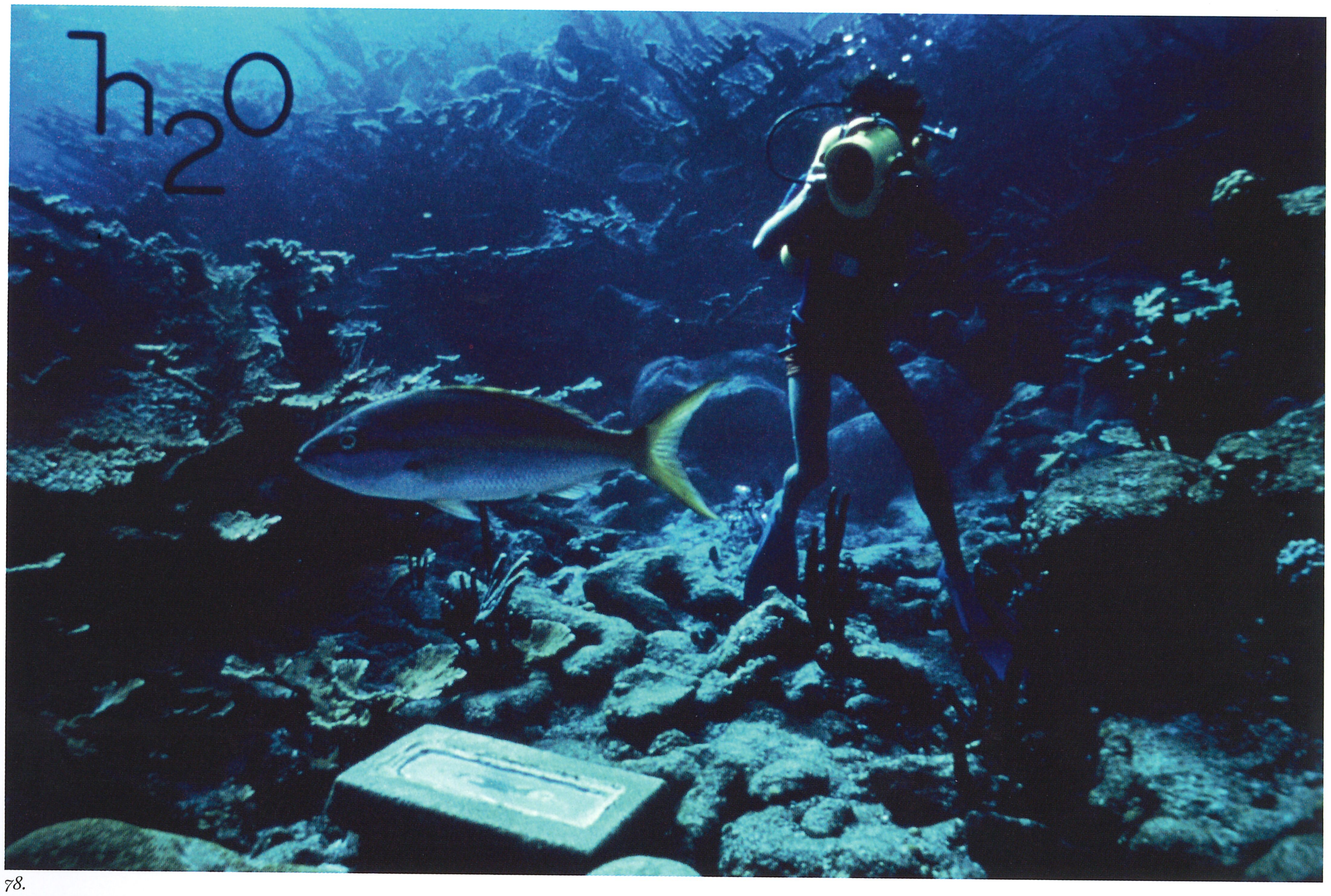
72.

73.

74.

72. Valeriy Borzov winning gold, 1972 Olympic Games, Munich, Germany (Topham Picturepoint)
73. School in Eastern Hokkaido, Japan (Yutaka Nagata)
74. Children with globe at the United Nations International School (Yutaka Nagata)

75.



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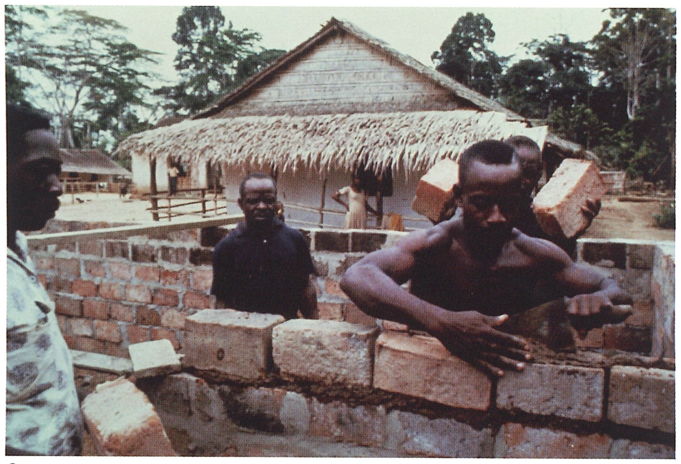
75. Cotton harvesting, New South Wales, Australia. (Howell Walker)
76. Grape picker near Griffith, New South Wales, Australia (David Moore)
77. Supermarket (Herman Eckelmann)
78. Diver and fish, Buck Island Reef National Monument, St. Croix, U.S. Virgin Islands (Jerry Greenberg)
79. Fishermen at Evia, Greece (Tsagris)
80. Cooking fish (Brian Seed)
81. Chinese dinner party (Michael Rougier)
82. Demonstration of licking, eating, and drinking (Herman Eckelmann)
83. The Great Wall of China (Edward Kim)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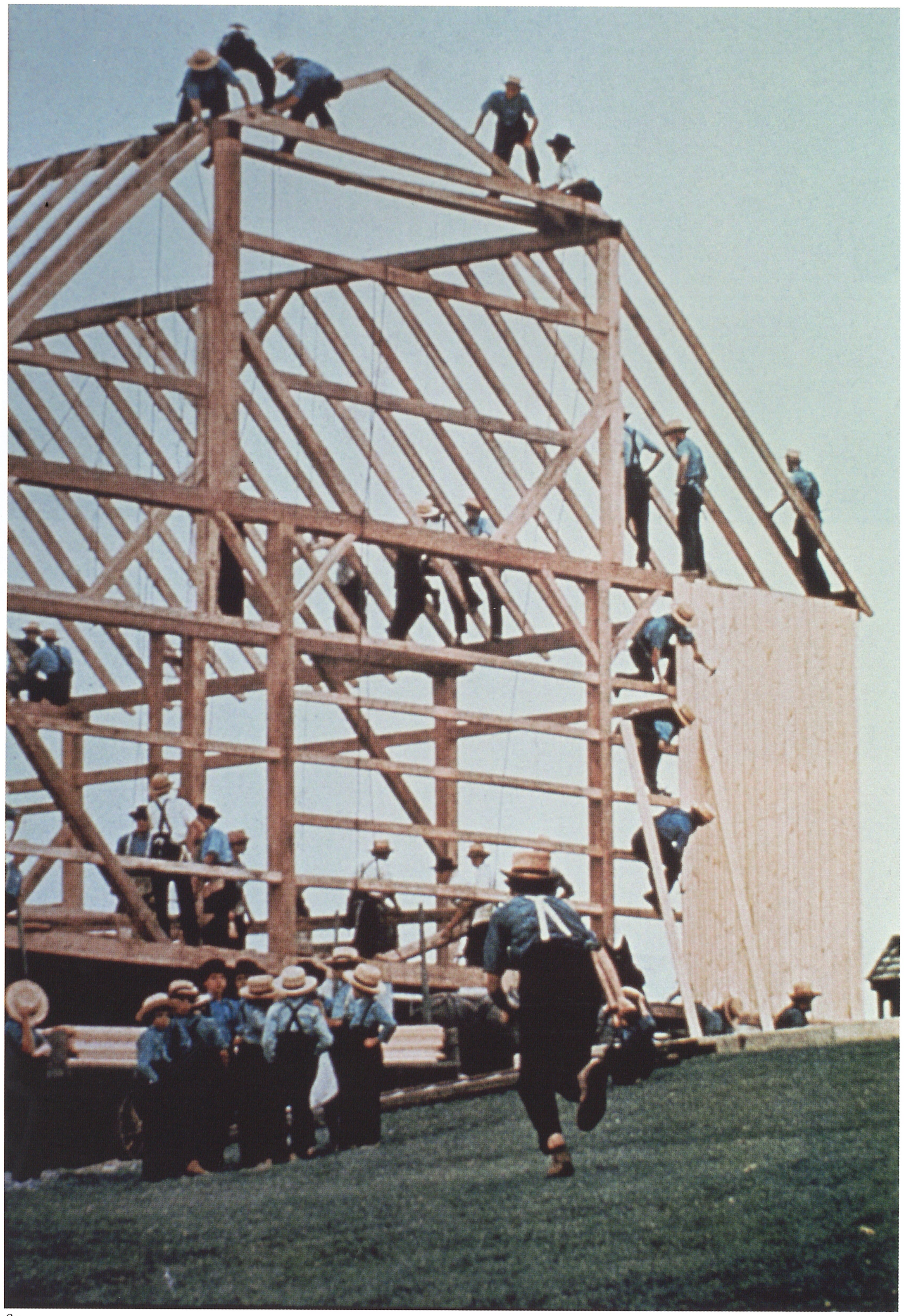
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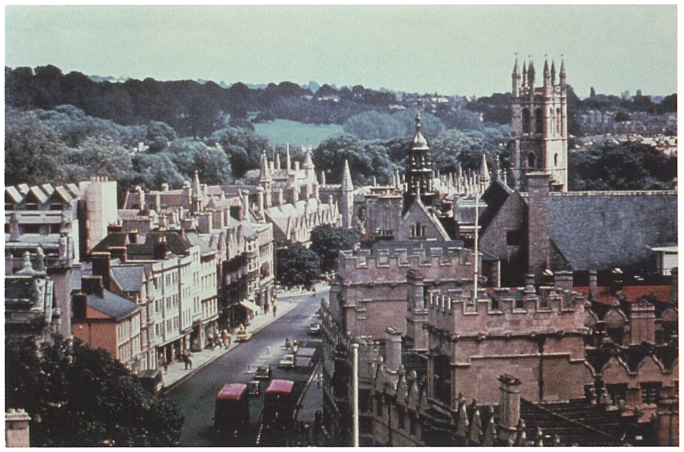

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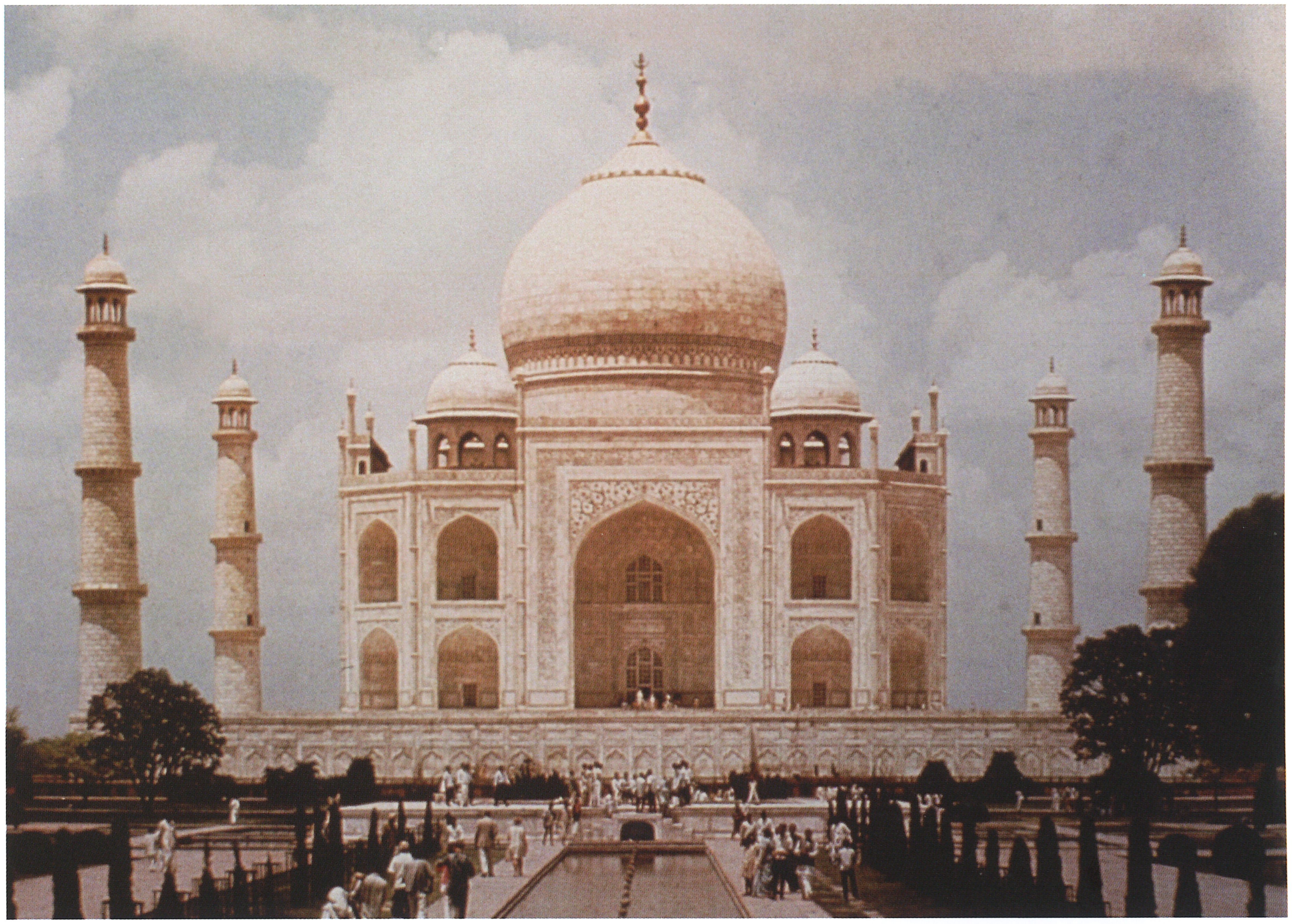

90.

84. Home construction in Sangmélima, Republic of Cameroon (UN)
85. Amish barn raising (William Albert Allard)
86. Rural house in Bishoftu, Ethiopia (Ray Witlin)
87. House in Provincetown, Massachusetts (Robert Sisson)
88. House in Cloudcroft, New Mexico (Frank Drake)
89. Home interior (James L. Amos)
90. Taj Mahal (David Carroll)
91. Oxford, England (Douglas R. Gilbert)
92. Sailboats in the Charles River Basin, Boston, Massachusetts (Ted Spiegel)

93.

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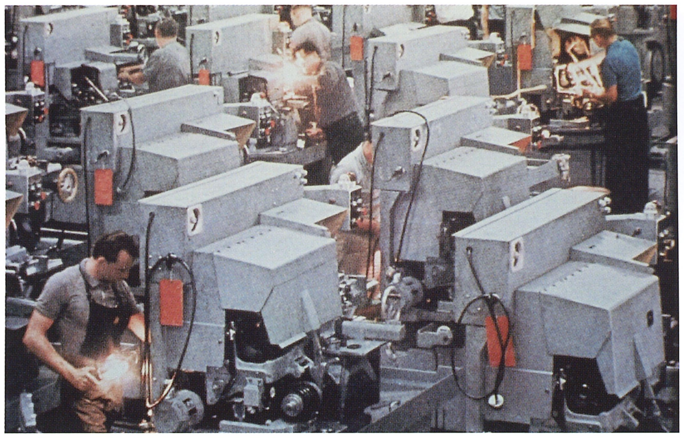

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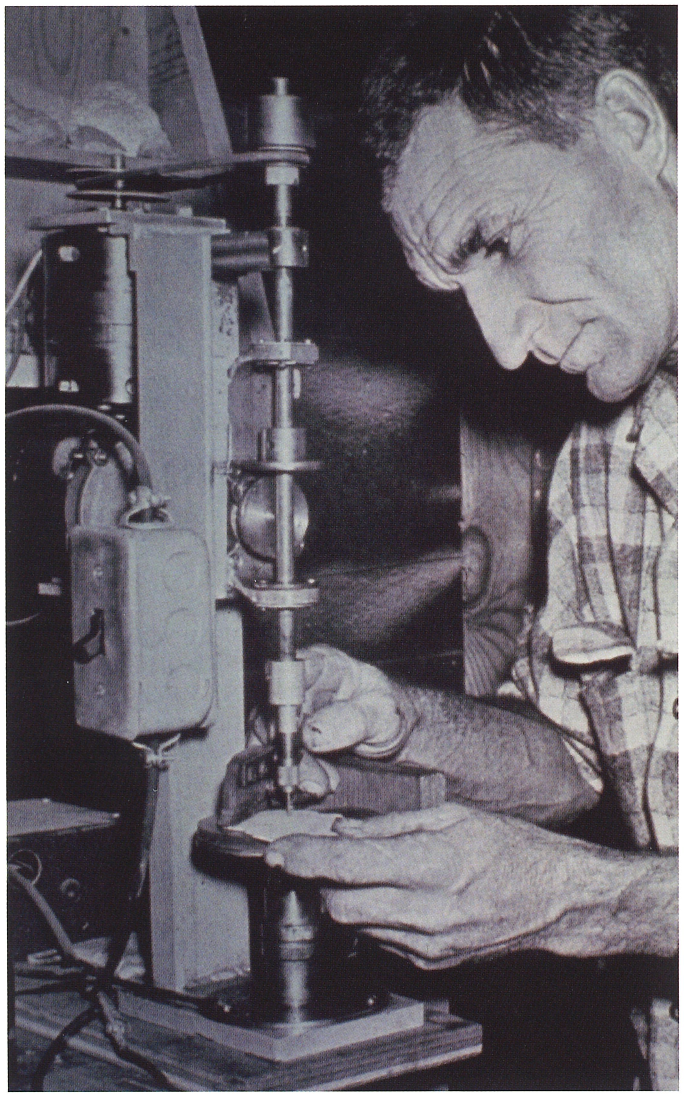

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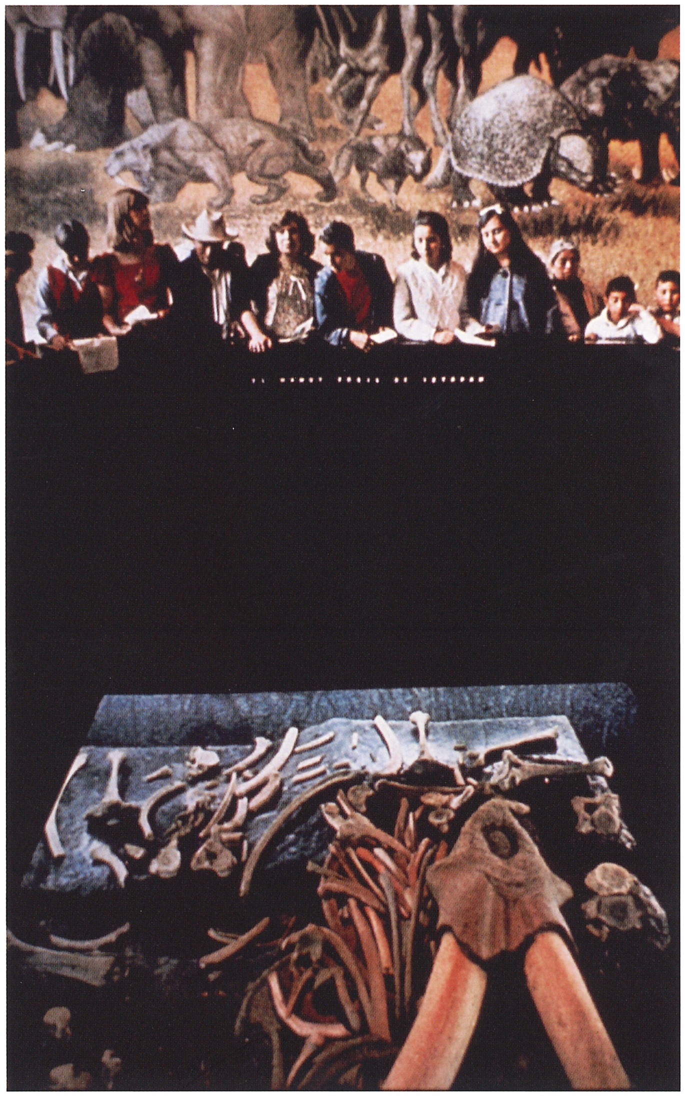

98.

100.

101.

93–94. Headquarters of the United Nations, day and night (UN/Yutaka Nagata)
95. Sydney Opera House (Michael E. Long)
96. Artisan with drill (Frank Hewlett)
97. Factory interior (Fred Ward)
98. Visitors at a museum (David Cupp)
99. X-ray of a hand (Herman Eckelmann)
100. Woman with microscope in a Mogadishu health center (Rice)
101. Street scene in Lahore, Pakistan (B. Wolff)

102.

103.

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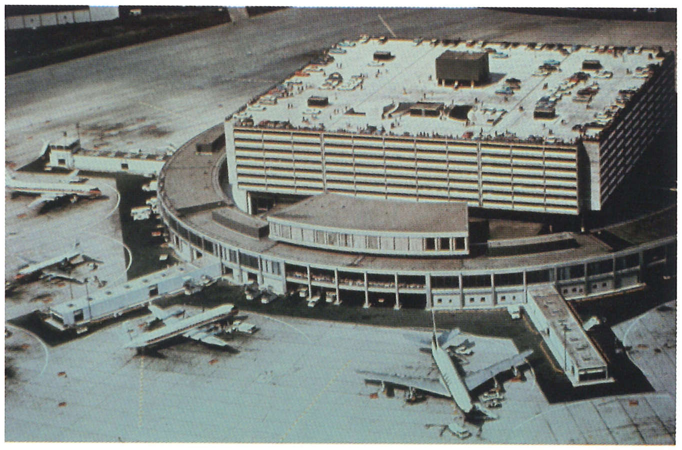
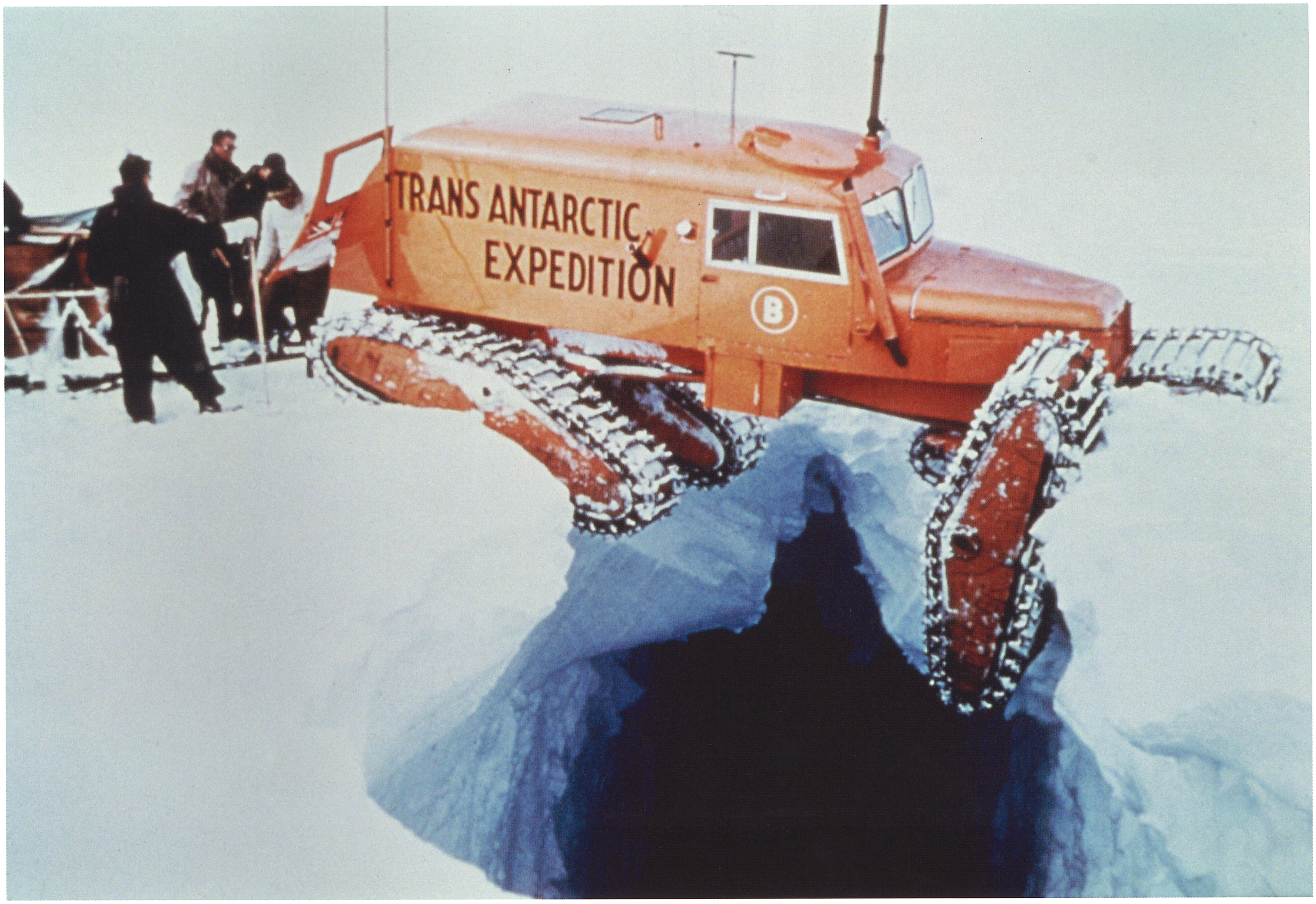


107.

102. Rush hour in Bangkok, Thailand (UN)
103. Route 13, Ithaca, New York (Herman Eckelmann)
104. The Golden Gate and Bridge from Baker Beach, San Francisco, California (Ansel Adams)
105. TurboTrain linking Boston to New York (Gordon Gahan)
106. Airplane from runway at Syracuse Hancock International Airport (Frank Drake)
107. Toronto Pearson International Airport Terminal 1 (Ray Manley)



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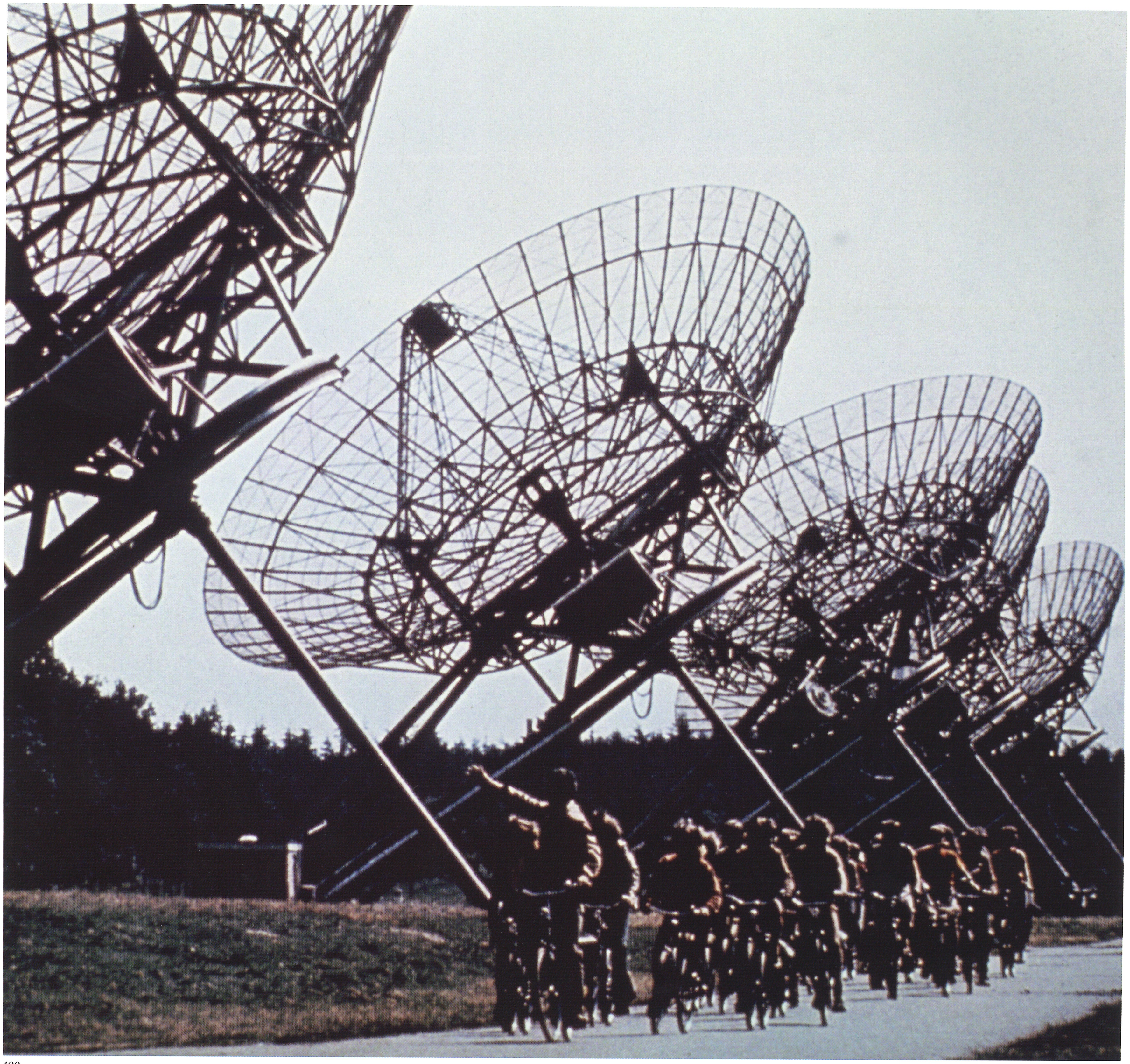
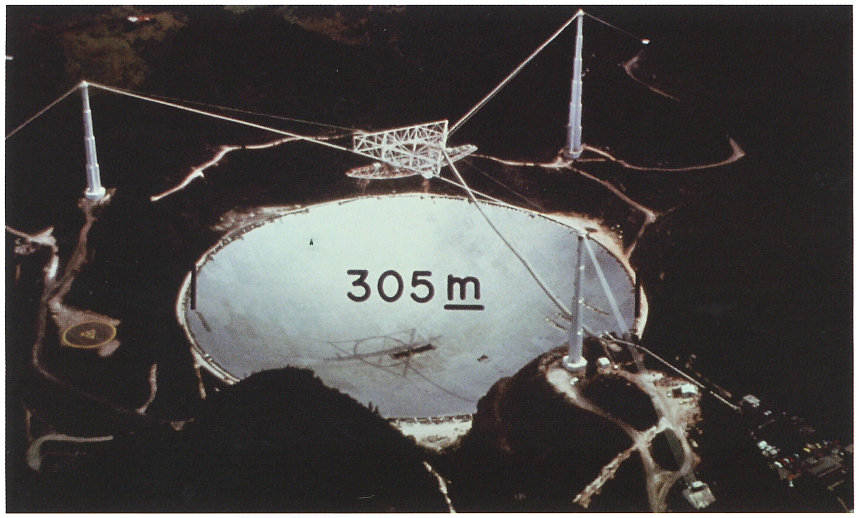


109.

108. Sno-Cat hanging over crevasse,
Trans-Antarctic Expedition, 1955–1958
(George Lowe)
109. The Westerbork Synthesis Radio Telescope,
The Netherlands (James P. Blair)



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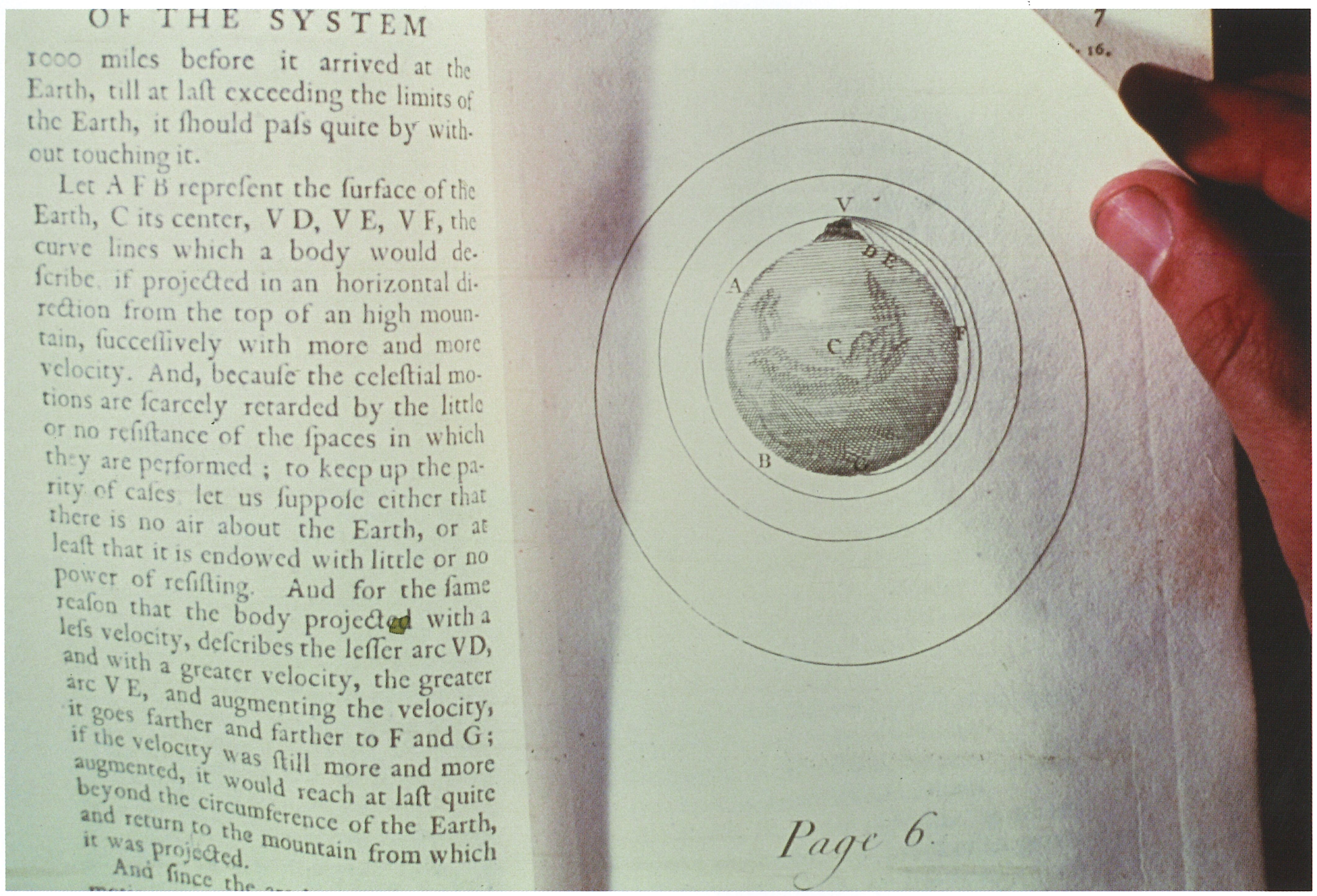


OF THE SYSTEM

7

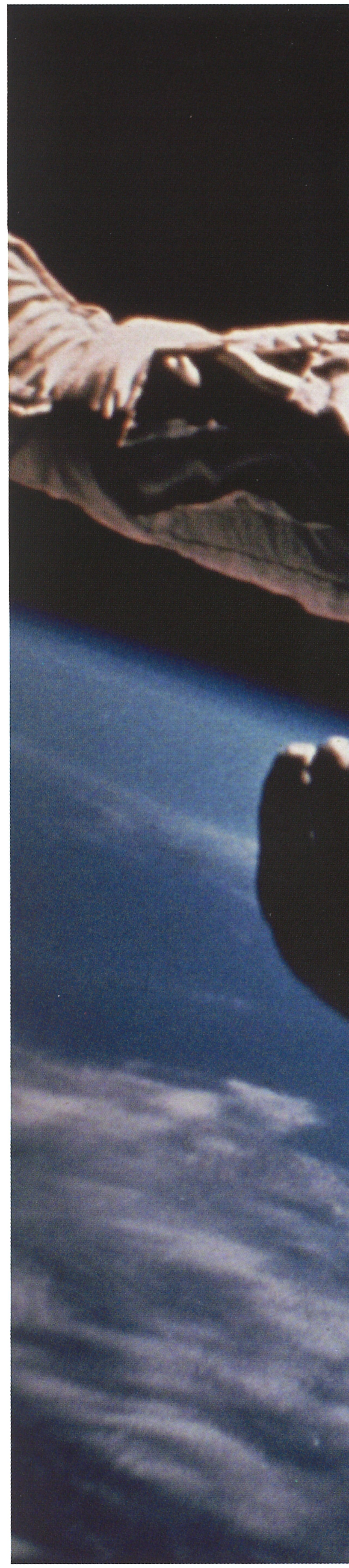
16.

1000 miles before it arrived at the Earth, till at laſt exceeding the limits of the Earth, it ſhould paſs quite by without touching it.

Let A F B repreſent the ſurface of the Earth, C its center, V D, V E, V F, the curve lines which a body would deſcribe, if projected in an horizontal direction from the top of an high mountain, ſucceſſively with more and more velocity. And, becauſe the celeſtial motions are ſcarcely retarded by the little or no reſiſtance of the ſpaces in which they are performed; to keep up the parity of caſes, let us ſuppoſe either that there is no air about the Earth, or at leaſt that it is endowed with little or no power of reſiſting. And for the ſame reaſon that the body projected with a leſs velocity, deſcribes the leſſer arc VD, and with a greater velocity, the greater arc VE, and augmenting the velocity, it goes farther and farther to F and G; if the velocity was ſtill more and more augmented, it would reach at laſt quite beyond the circumference of the Earth, and return to the mountain from which it was projected.

And ſince the

111.



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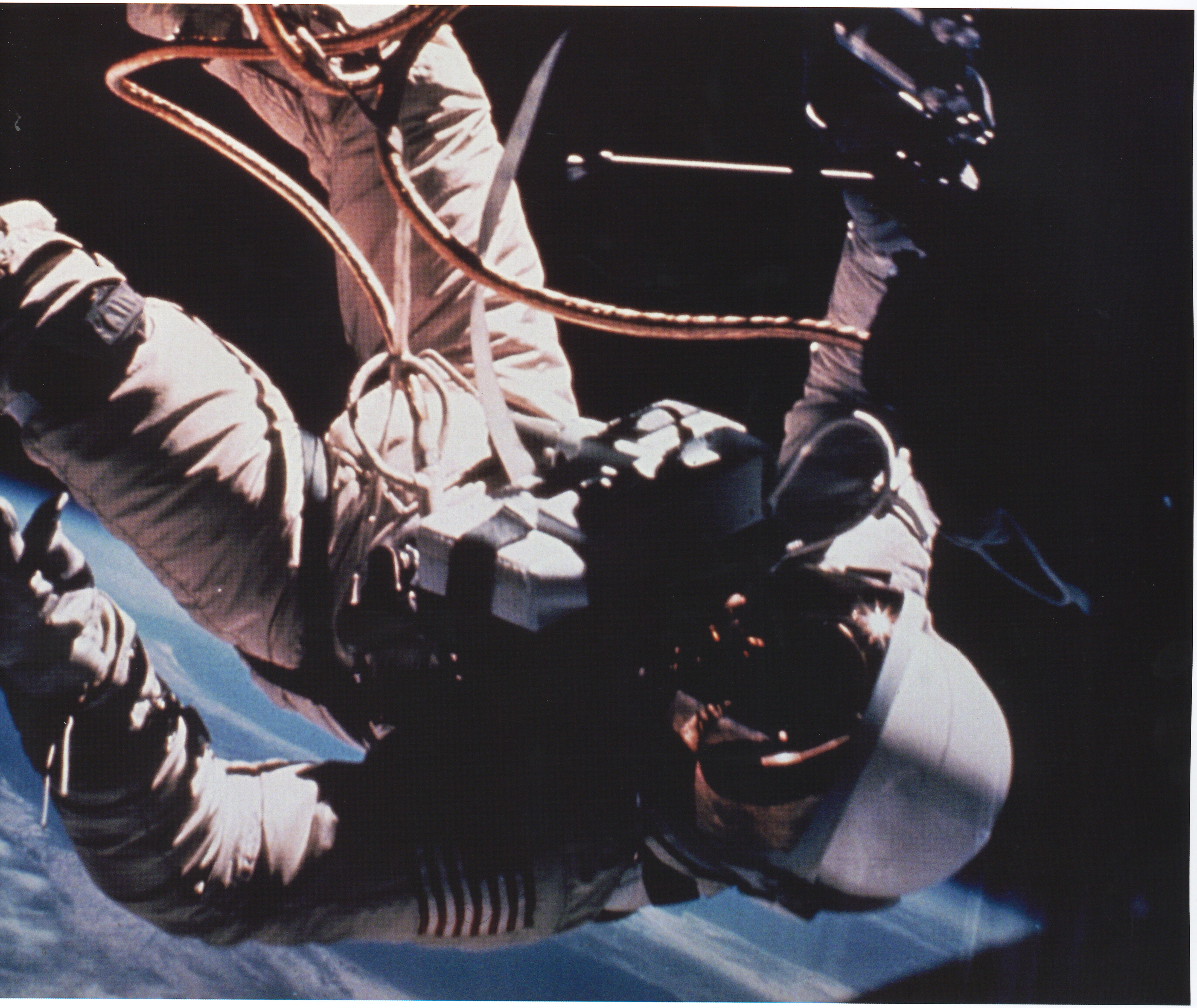
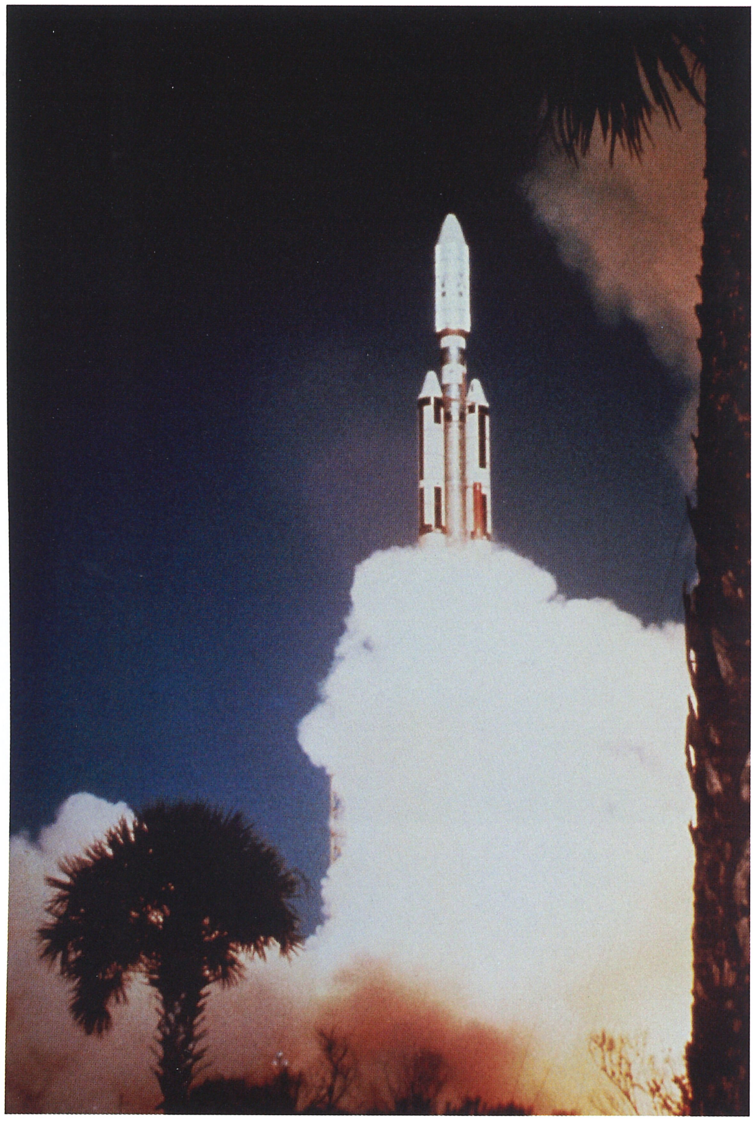


110. Arecibo Observatory, Puerto Rico (Herman Eckelmann)

111. Pages from Sir Isaac Newton's Philosophiæ Naturalis Principia Mathematica, Book 3: De Mundi Systemate *(Jon Lomberg)*

112. Gemini 4 astronaut Ed White, the first American to conduct a spacewalk (James McDivitt)

114.



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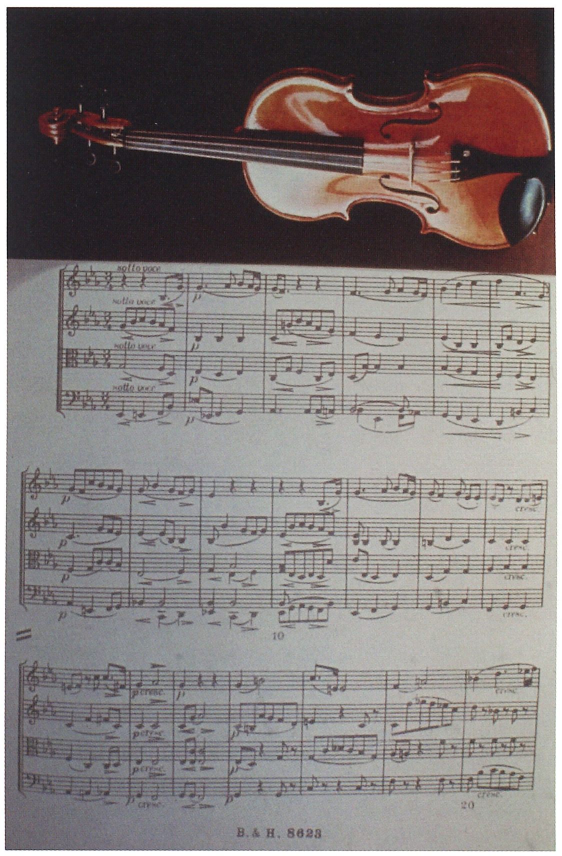

116.

113. Liftoff of Titan IIIE-Centaur rocket (NASA)
114. Whistling swans at sunset, Back Bay National Wildlife Refuge, Virginia (David Alan Harvey)
115. Quartetto Italiano
116. Beethoven's String Quartet No. 13 In B-flat Major, Opus 130: V. Cavatina, the closing piece of music on the Voyager Interstellar Record (Jon Lomberg)

STATEMENT

This Voyager spacecraft was constructed by the United States of America. We are a community of 240 million human beings among the more than 4 billion who inhabit the planet Earth. We human beings are still divided into nation states, but these states are rapidly becoming a single global civilization.

We cast this message into the cosmos. It is likely to survive a billion years into our future, when our civilization is profoundly altered and the surface of the Earth may be vastly changed. Of the 200 billion stars in the Milky Way galaxy, some -- perhaps many -- may have inhabited planets and spacefaring civilizations. If one such civilization intercepts Voyager and can understand these recorded contents, here is our message:

> This is a present from a small distant world, a token of our sounds, our science, our images, our music, our thoughts and our feelings. We are attempting to survive our time so we may live into yours. We hope someday, having solved the problems we face, to join a community of galactic civilizations. This record represents our hope and our determination, and our good will in a vast and awesome universe.

Jimmy Carter

President of the United States
of America

THE WHITE HOUSE,
June 16, 1977

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LAWRENCE COUGHLIN
JOSEPH M. McDADE
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121.

117. Statement from President Jimmy Carter
118–121. Select members of the U.S. Congress


ARTS & CRAFTS
UNIS

GREETINGS FROM EARTH

Over two days in June 1977, dozens of people in Ithaca, New York, stepped up to a microphone to pay their regards to the cosmos. Linda Salzman Sagan, David Gluck, and Joe Leeming had outfitted a makeshift recording studio in a Cornell University administration office to collect brief greetings in as many of Earth's most widely spoken languages as the impending project deadline allowed.

Faculty and staff from the language departments at Cornell referred many of the speakers, and friends convinced friends. Word spread across the university's myriad international communities. Of course, no one in the golden record committee imagined that extraterrestrials would understand Sumerian, Chinese, Nepali, or any of our spoken languages.

"There were two audiences for whom this message was being prepared—those of us who inhabit Earth, and those who exist on the planets of distant stars," wrote Salzman Sagan in *Murmurs of Earth*.

Two individuals had very personal connections to the project. The Arabic speaker, Amahl Shakhashiri Drake, is Frank Drake's wife and also helped curate the Voyager record picture sequence. The final greeting comes from six-year-old Nick Sagan, son of Carl Sagan and Linda Salzman Sagan. Nick reminds us that with respect to the universe, our civilization is still in its infancy: "Hello from the children of planet Earth."

GREETINGS IN 55 LANGUAGES

LANGUAGE	GREETING	ENGLISH TRANSLATION	SPEAKER
SUMERIAN	Silima khemen	May all be well.	David I. Owen
GREEK	οἵτινες, ποτ᾽ ἐστε, χαίρετε. εἰρηνικῶς, πρὸς φίλους ἐληλύθαμεν φίλοι.	Greetings to you, whoever you are. We come in friendship to those who are friends.	Frederick M. Ahl
PORTUGUESE	Paz e felicidade a todos.	Peace and happiness to all.	Janet Sternberg
CANTONESE	各位好嗎？祝各位平安健康快樂。	Hi. How are you? Wish you peace, health and happiness.	Stella Fessler
AKKADIAN	Adannish lu shulmu.	May all be very well.	David I. Owen
RUSSIAN	Здравствуйте, приветствую вас!	Be healthy—I greet you.	Maria Rubinova
THAI	สวัสดีค่ะ สหายในธรณีโพ้น พวกเราในธรณีนี้ขอส่งมิตรจิตรมาถึงท่านทุกคน	We in this world send you our good will.	Ruchira Mendiones
ARABIC	تَحِيَّاتُنَا لِلأَصْدِقَاءِ فِي النُّجُوم يَالَيْتَ يَجْمَعُنَا الزَّمَان	Greetings to our friends in the stars. We wish that we will meet you someday.	Amahl Shakhashiri
ROMANIAN	Salutări la toată lumea.	Greetings to everybody.	Sanda Huffman
FRENCH	Bonjour tout le monde.	Good day to the entire world.	Alexandra Littauer
BURMESE	မာရဲ့လား ခင်ဗျာ။ Ma-ye. la: hkamya	Are you well?	Maung Myo Lwin
HEBREW	Shalóm	Peace.	David I. Owen
SPANISH	Hola y saludos a todos.	Hello and greetings to all.	Erik J. Beukenkamp
INDONESIAN	Selamat malam hadirin sekalian, Selamat berpísah, Sampai bertemu lagi dilain waktu.	Good night ladies and gentlemen. Goodbye and see you next time.	Ilyas Harun

LANGUAGE	GREETING	ENGLISH TRANSLATION	SPEAKER
KECHUA (QUECHUA)	Kay pachamanta pitapas maytapas rimapayastin, runa simipi.	Hello to everybody from this Earth, in Kechua language.	Fredy Amilcar and Roncalla Fernandez
PUNJABI	ਜੀ ਆਇਆਂ ਨੂੰ. ਤੁਹਾਨੂੰ ਮਿਲਕੇ ਬਹੁਤ ਖੁਸ਼ੀ ਹੋਈ.	Welcome home. It is a pleasure to receive you.	Jatinder N. Paul
HITTITE	Ashshuli.	Hail.	David I. Owen
BENGALI	নমস্কার ! বিশ্বে শান্তি হোক	Hello! Let there be peace everywhere.	Subrata Mukherjee
LATIN	Salvete quiquumque estis; bonam erga vos voluntatem habemus, et pacem per astra ferimus.	Greetings to you, whoever you are: we have good will towards you and bring peace across space.	Frederick M. Ahl
ARAMAIC	Shalám	Peace.	David I. Owen
DUTCH	Hartelghe groeten aen iadereen.	Heartfelt greetings to everyone.	Joan de Boer
GERMAN	Herzliche grüsse an alle.	Heartfelt greetings to all.	Renate Born
URDU	ہم زمین کے باشندوں کی طرف سے آپ کو خوش آمدید کہتے ہیں	Peace on you. We the inhabitants of this earth send our greetings to you.	Salma Alzal
VIETNAMESE	Chân thành giu dén cáo ban lò'i cháo thân hu'u.	Sincerely send you our friendly greetings.	Tran Trong Hai
TURKISH	Sayın Türkçe bilen arkadaşlarımız: Sabah şereflerinizi hayirli olsun!	Dear Turkish-speaking friends, may the honors of the morning be upon your heads.	Peter Ian Kuniholm
JAPANESE	こんにちはお元気ですか。	Hello. How are you?	Mari Noda
HINDI	हम धर्ती के निवासी आप का स्वागत करते हैं।	Greetings from the inhabitants of this world.	Omar Alzal
WELSH	Iechyd da i chwi yn awr ac yn oes oesoedd.	Good health to you now and forever.	Frederick M. Ahl

LANGUAGE	GREETING	ENGLISH TRANSLATION	SPEAKER
ITALIAN	Tanti saluti e auguri.	Many greetings and wishes.	Debby Grossvogel
SINHALESE	ආයුබෝවන්	Greetings.	Kamal de Abrew
NGUNI (ZULU)	Siya nibingelela maqhawe sinifisela inkonzo ende.	We greet you, great ones. We wish you longevity.	Fred Dube
SOTHO (SESOTHO)	Reani lumelisa marela.	We greet you, O great ones.	Fred Dube
WU	祝 你 们 大 家 好	Best of wishes to you all.	Yvonne Meinwald
ARMENIAN	[illegible]	To all those who exist in the universe, greetings.	Araxy Terzian
KOREAN	안 녕 하 세 요 ?	How are you?	Soon Hee Shin
POLISH	Watajcie, istoty zza światów!	Welcome, creatures from beyond the outer world.	Maria Nowakowska-Stykos
NEPALI	पृथ्वीवासीहरूबाट शान्तिमय भविष्यको शुभकामना!	Wishing you a peaceful future from the earthlings!	Durga Prashad Ojha
MANDARIN CHINESE	各位都好吧，我們都很想念你們，有空請到這來玩。	Hope everyone's well. We are thinking about you all. Please come here to visit us when you have time.	Liang Ku
ILA (LAMBIA)	Mypone kabotu noose.	We wish all of you well.	Saul Moobola
SWEDISH	Hälsmingar från en data programmerare i den lilla universitats staden Ithaca på planeten jorden.	Greetings from a computer programmer in the little university town of Ithaca on the planet Earth.	Gunnel Almgren Schaar
NYANJA	Mulibwanji imwe boonse bantu bakumwamba.	How are all you people of other planets?	Saul Moobola
GUJARATI	પૃથ્વી ઉપર વસનાર એક માનવ તરફથી બ્રહ્માંડના અન્ય અવકાશમાં વસનારાઓને અભિનંદન. કૃપયા સંદેશો મોકલાવશો.	Greetings from a human being of the Earth. Please contact.	Radhekant Dave

LANGUAGE	GREETING	ENGLISH TRANSLATION	SPEAKER
UKRAINIAN	ПЕРЕСИЛАЕМО ПРИВІТ ІЗ НАШОГО СВІТУ, БАЖАЕМО ЩАСТЯ, ЗДОРОВЯ, І МНОГАЯ ЛІТА.	We are sending greetings from our world, wishing you happiness, good health and many years.	Andrew Cehelsky
PERSIAN	درود بر ساکنین کرات دور دست	Hello to the residents of far skies.	Eshagh Samehyeh
SERBIAN	ЖЕЛИМО ВАМ СВЕ НАЈБОЉЕ СА НАШЕ ПЛАНЕТЕ	We wish you everything good from our planet.	Milan M. Smiljanic
ORIYA	"ସୂର୍ଯ୍ୟ" ତାରକାର ତୃତୀୟ ଗ୍ରହ "ପୃଥିବୀ"ରୁ ବିଶ୍ୱ ବ୍ରହ୍ମାଣ୍ଡର ଅଧିବାସୀମାନଙ୍କୁ ଅଭିନନ୍ଦନ ।	Greetings to the inhabitants of the universe from the third planet Earth of the star of the Sun.	Raghaba Prasada Sahu
LUGANDA (GANDA)	Musulayo mutya abantu bensi eno mukama abawe emirembe bulijo.	Greetings to all peoples of the universe. God give you peace always.	Elijah Mwima-Mudeenya
MARATHI	नमस्कार. ह्या पृथ्वीतील लोक तुम्हाला त्यांचे शुभविचार पाठवितात. आणि त्यांची आशा आहे कि तुम्हीं ह्या जन्मी धन्य हो.	Greetings. The people of the Earth send their good wishes.	Arati Pandit
AMOY	太空朋友你們好！你們吃過飯嗎？有空來這兒坐坐。	Friends of space, how are you all? Have you eaten yet? Come visit us if you have time.	Margaret Sook Ching See Gebauer
HUNGARIAN (MAGYAR)	Üdvözletet küldünk magyar nyelven minden békét szeretö lénynek a világegyetemen.	We are sending greetings in the Hungarian language to all peace-loving beings in the Universe.	Elizabeth Bilson
TELUGU	నమస్తే. తెలుగు మాట్లాడే జనముల నుంచి మా శుభాకాంక్షలు.	Greetings. Best wishes from Telugu-speaking people.	Prasad Kodukula
CZECH	Mily přátelé, přejeme vam vše nejlepši.	Dear Friends, we wish you the best.	V.O. Kostroun
KANNADA (KANARESE)	ಕನ್ನಡಿಗರ ಪರವಾಗಿ ಶುಭಾಶಯಗಳು	Greetings. On behalf of Kannada-speaking people, "good wishes."	Shrinivasa K. Upadhyaya
RAJASTHANI	सब भाइयों ने म्हारो राम राम पहूँचे। हमा अठे खुशी हाँ तुम्हा वहाँ खुशी रहीजो।	Hello to everyone. We are happy here and you be happy there.	Mool C. Gupta
ENGLISH	Hello from the children of the plan et Earth. 	Hello from the children of planet Earth.	Nick Sagan

This and the preceding pages are based on a table prepared during the 1977 recording sessions by Shirley Arden, Carl Sagan's executive assistant at Cornell's Laboratory for Planetary Studies.


THE SOUNDS OF EARTH
Side 1
UNITED STATES OF AMERICA
PLANET EARTH
TO THE MAKERS OF MUSIC - ALL WORLDS, ALL TIMES
SIDE A

THE SOUNDS OF EARTH

GREETING FROM KURT WALDHEIM, SECRETARY-GENERAL OF THE UNITED NATIONS

GREETINGS IN 55 LANGUAGES

UNITED NATIONS GREETINGS/ WHALE SONGS

Mohamed El-Zoeby, Egypt (Arabic)
Chaidir Anwar Sani, Indonesia (Indonesian)
Bernadette Lefort, France (French)
Syed Azmat Hassan, Pakistan (Punjabi)
Peter Jankowitsch, Austria (German)
Robert B. Edmonds, Canada (English)
Wallace R.T. Macaulay, Nigeria (Efik)
James F. Leonard, United States (English)
Juan Carlos Valero, Chile (Spanish)
Eric Duchene, Belgium (Flemish)
Samuel Ramsay Nicol, Sierra Leone (English)
Wallace R.T. Macaulay, Nigeria (English)
Bahram Moghtaderi, Iran (Persian)
Ralph Harry, Australia (Esperanto)
Anders Thunboig, Sweden (Swedish)
Whale songs courtesy of Roger Payne/Ocean Alliance

SOUNDS OF EARTH

Music of the Spheres
Volcanoes, Earthquake, Thunder
Mud Pots
Wind, Rain, Surf
Crickets, Frogs
Birds, Hyena, Elephant
Chimpanzee
Wild Dog
Footsteps, Heartbeats, Laughter
Fire, Speech
The First Tools
Tame Dog
Herding Sheep, Blacksmith Shop, Sawing, Tractor, Riveter
Morse Code
Ships, Horse and Cart, Train, Truck, Tractor, Bus, Automobile, F-111 Flyby, Saturn 5 Liftoff
Kiss
Mother and Child
EEG/Life Signs
Pulsar

Sound effects and field recordings courtesy of the Elektra Sound Effects Library. Produced under license from Elektra Entertainment Group Inc. except: "Kepler's Harmony of the Worlds" (Music of the Spheres) courtesy of Laurie Spiegel Publishing (ASCAP); Earthquake courtesy of David Simpson, Lamont Doherty Earth Observatory, Columbia University; Crickets (Teleogryllus oceanicus) courtesy of Ronald R. Hoy, Department of Neurobiology and Behavior, Cornell University; Birds recorded by James Gulledge, Laboratory of Ornithology, Cornell University; !Kung speech courtesy of Richard Lee, Department of Anthropology, University of Toronto; Morse Code provided by William R. Schoppe Jr.; Train and Saturn 5 Liftoff recorded by Alan Botto; Mother and Child provided by Margaret Bullowa and Lise Menn, Speech Communication Laboratory of the Research Laboratory of Electronics, Massachusetts Institute of Technology; EEG/Life Signs recorded by Julius Korein, MD, New York University School of Medicine; Pulsar courtesy of Frank Drake.

BRANDENBURG CONCERTO NO. 2 IN F MAJOR, BWV 1047: I. ALLEGRO

Composed by Johann Sebastian Bach
Performed by Munich Bach Orchestra/Karl Richter (conductor) featuring Karl-Heinz Schneeberger (violin)
Recorded in Munich, Germany, January 1967.
Courtesy of Deutsche Grammophon. Produced under license from Universal Music Enterprises.

KETAWANG: PUSPÅWÅRNÅ (KINDS OF FLOWERS)

Performed by Pura Paku Alaman Palace Orchestra/K.R.T. Wasitodipuro (director) featuring Niken Larasati and Nji Tasri (vocals)
Recorded by Robert E. Brown in Yogyakarta, Java, Indonesia, on January 10, 1971.
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CENGUNMÉ

Performed by Mahi musicians of Benin
Recorded by Charles Duvelle in Savalou, Benin, West Africa, January 1963.
Courtesy of Charles Duvelle.

ALIMA SONG

Performed by Mbuti of the Ituri Rainforest
Recorded by Colin Turnbull and Francis S. Chapman in the Ituri Rainforest of the Democratic Republic of Congo, circa 1951.
"Alima Song" from the recording Music of the Ituri Forest, *FW04483, courtesy of Smithsonian Folkways Recordings. ℗ (c) 1957. Used by permission.*

BARNUMBIRR (MORNING STAR) AND MOIKOI SONG

Performed by Tom Djawa (clapsticks), Mudpo (didgeridoo), and Waliparu (vocals)
Recorded by Sandra LeBrun Holmes at Milingimbi Mission on Milingimbi Island, off the coast of Arnhem Land, Northern Territory, Australia, 1962.

EL CASCABEL

Composed by Lorenzo Barcelata
Performed by Antonio Maciel and Los Aguilillas with Mariachi México de Pepe Villa/Rafael Carrión (conductor)

JOHNNY B. GOODE

Written and performed by Chuck Berry (vocals, guitar) with Lafayette Leak (piano), Willie Dixon (bass), and Fred Below (drums)
Recorded at Chess Studios, Chicago, Illinois, on January 6, 1958.

MARIUAMANGɨ

Performed by Pranis Pandang and Kumbui (mariuamangɨ) of the Nyaura clan
Recorded by Robert MacLennan in the village of Kandɨngei, Middle Sepik, Papua New Guinea, on July 23, 1964.

SOKAKU-REIBO (DEPICTING THE CRANES IN THEIR NEST)

Arranged by Kinko Kurosawa
Performed by Goro Yamaguchi (shakuhachi)
Recorded in New York City, circa 1967.

PARTITA FOR VIOLIN SOLO NO. 3 IN E MAJOR, BWV 1006: III. GAVOTTE EN RONDEAU

Composed by Johann Sebastian Bach
Performed by Arthur Grumiaux (violin)
Recorded in Berlin, Germany, November 1960.

THE MAGIC FLUTE (DIE ZAUBERFLÖTE), K. 620, ACT II: HELL'S VENGEANCE BOILS IN MY HEART

Composed by Wolfgang Amadeus Mozart
Performed by Bavarian State Opera Orchestra and Chorus/Wolfgang Sawallisch (conductor) featuring Edda Moser (soprano)
Recorded in Munich, Germany, August 1972.

CHAKRULO

Performed by Georgian State Merited Ensemble of Folk Song and Dance/Anzor Kavsadze (director) featuring Ilia Zakaidze (first tenor) and Rostom Saginashvili (second tenor)
Recorded at Melodiya Studio in Tbilisi, Georgia.

RONCADORAS AND DRUMS

Performed by musicians from Ancash
From recordings collected by Jose Maria Arguedas (Casa de la Cultura) in the Ancash Region of Peru, 1964.

MELANCHOLY BLUES

Written by Marty Bloom and Walter Melrose
Performed by Louis Armstrong and His Hot Seven
Recorded in Chicago, Illinois, on May 11, 1927.

MUĞAM

Performed by Kamil Jalilov (balaban)
Recorded by Radio Moscow, circa 1950.

THE RITE OF SPRING (LE SACRE DU PRINTEMPS), PART II—THE SACRIFICE: VI. SACRIFICIAL DANCE (THE CHOSEN ONE)

Composed by Igor Stravinsky
Performed by Columbia Symphony Orchestra/Igor Stravinsky (conductor)
Recorded at the Ballroom of the St. George Hotel, Brooklyn, New York, on January 6, 1960.

THE WELL-TEMPERED CLAVIER, BOOK II: PRELUDE & FUGUE NO. 1 IN C MAJOR, BWV 870

Composed by Johann Sebastian Bach
Performed by Glenn Gould (piano)
Recorded at CBS 30th Street Studio in New York City on August 8, 1966.
Courtesy of Sony Classical. Produced under license from Sony Music Commercial Music Group.

SYMPHONY NO. 5 IN C MINOR, OPUS 67: I. ALLEGRO CON BRIO

Composed by Ludwig Van Beethoven
Performed by Philharmonia Orchestra/ Otto Klemperer (conductor)
Recorded at Kingsway Hall, London, on October 6, 1955.
Produced under license from Warner Classics UK Ltd.

IZLEL E DELYU HAYDUTIN

Performed by Valya Balkanska (vocal), Lazar Kanevski, and Stephan Zahmanov (kaba gaidi)
Recorded by Martin Koenig and Ethel Raim in Smolyan, Bulgaria, 1968.
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NAVAJO NIGHT CHANT, YEIBICHAI DANCE

Performed by Ambrose Roan Horse, Chester Roan, and Tom Roan
Recorded by Willard Rhodes in Pine Springs, Arizona, Summer 1942.
"Night Chant, Yeibichai Dance" from the recording Music of the American Indians of the Southwest, *FW04420, courtesy of Smithsonian Folkways Recordings. ℗ © 1951. Used by permission.*

THE FAIRIE ROUND

Composed by Anthony Holborne
Performed by Early Music Consort of London/ David Munrow (director)
Recorded at Abbey Road Studios, London, September 1973.
℗ 1976 Erato/Warner. Produced under license from Warner Music UK Ltd.

NARANARATANA KOOKOKOO (THE CRY OF THE MEGAPODE BIRD)

Performed by Maniasinimae and Taumaetarau Chieftain Tribe of Oloha and Palasu'u Village Community in Small Malaita
Courtesy of the Solomon Islands Broadcasting Corporation (SIBC), formerly the Solomon Islands Broadcasting Services (SIBS).

WEDDING SONG

Performed by young girl of Huancavelica
Recorded by John and Penny Cohen in Huancavelica, Peru, 1964.
"Song of Marriage" from the recording entitled Mountain Music of Peru, Vol. 1, *SFW40020, courtesy of Smithsonian Folkways Recordings. ℗ © 1991. Used by permission.*

LIU SHUI (FLOWING STREAMS)

Performed by Guan Pinghu (guqin)
"Liushui" by Guan Pinghu from the recording China, *UNES08071, courtesy of Smithsonian Folkways Recordings. ℗ ©* 1985. *Used by permission.*

BHAIRAVI: JAAT KAHAN HO

Performed by Kesarbai Kerkar (vocals) with harmonium and tabla accompaniment
Recorded in Bombay, India, April 1953.
Produced under license from Silva Screen Music America.

DARK WAS THE NIGHT, COLD WAS THE GROUND

Written and performed by Blind Willie Johnson (slide guitar, vocals) in Dallas, Texas, on December 3, 1927.
Courtesy of Legacy Recordings. Produced under license from Sony Music Commercial Music Group.

STRING QUARTET NO. 13: IN B-FLAT MAJOR, OPUS 130: V. CAVATINA

Composed by Ludwig Van Beethoven
Performed by Budapest String Quartet
Recorded at the Library of Congress, Washington, D.C., on April 7, 1960.
Produced under license from Bridge Records.

1. Saturnian system montage

POSTCARDS FROM VOYAGER

As the Voyagers sailed through our solar system, carrying Earth's sounds and images to the stars, the probes also sent home many thousands of startling photos from their travels. In 1977, just two weeks after its September 5 launch, Voyager 1 gifted us with the first single-frame photo of Earth and our moon captured by a spacecraft. Two years later, the rich hues of Jupiter's Great Red Spot and active volcanoes on its moon Io left us awestruck. The following year, Voyager 1 revealed the intricacy of Saturn's rings at unprecedented resolution. In 1986, Voyager 2 captured the dramatic crescent of Uranus and detected 10 previously unseen moons orbiting that planet. Three years after that, Voyager 2 became the first spacecraft to observe Neptune, skimming the planet only 5,000 kilometers above its north pole.

Once the twin probes had completed their encounters with the outer planets, the time came to shut off their cameras to preserve power and memory for the other onboard scientific instruments. But before engineers flipped the switch, one last photo opportunity was not to be missed. Carl Sagan, a member of the Voyager Imaging Team, had persuaded NASA engineers to turn Voyager 1's cameras back toward the sun and take the first-ever portrait of our solar system from beyond its outer boundary. Sixty frames, taken on Valentine's Day, February 14, 1990, were combined into a single mosaic, known today as the "Solar System Portrait," albeit with Mars and Mercury lost in the sun's glare. Centered in a ray of scattered light in the camera's optics is a tiny speck, just .12 pixels in size: Earth from 6 billion kilometers away—a "pale blue dot," as Sagan called it. It's an iconic image that holds the power to shift our perspective in an instant.

"There is perhaps no better demonstration of the folly of human conceits than this distant image of our tiny world," Sagan wrote in *Pale Blue Dot* (1994). "To me, it underscores our responsibility to deal more kindly with one another, and to preserve and cherish the pale blue dot, the only home we've ever known."

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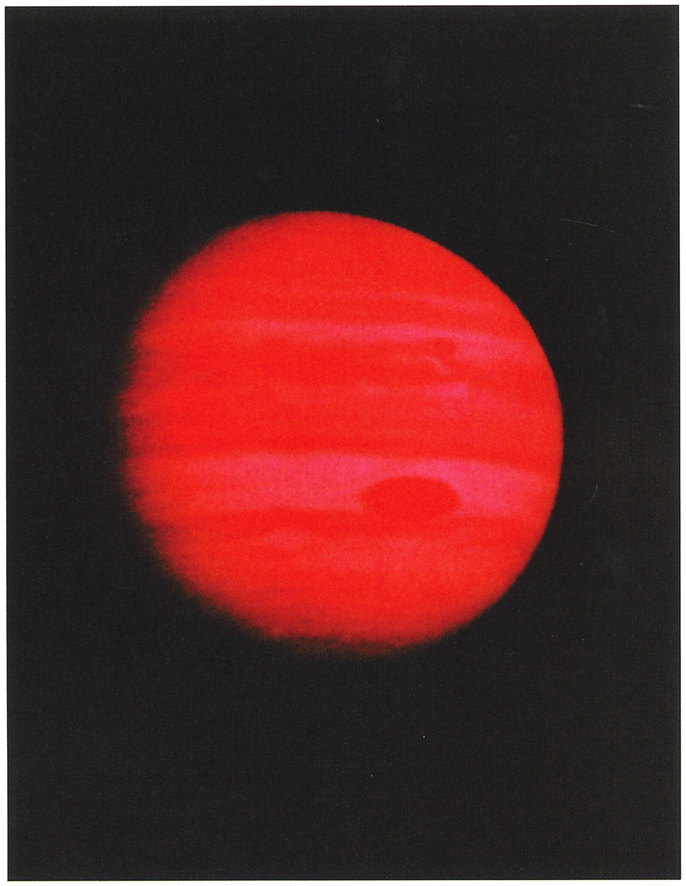

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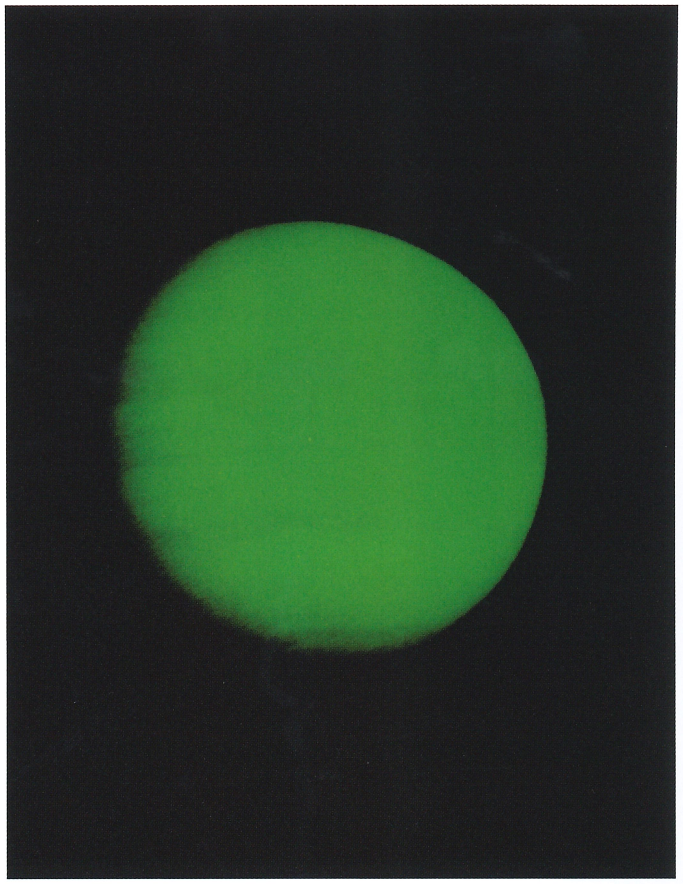

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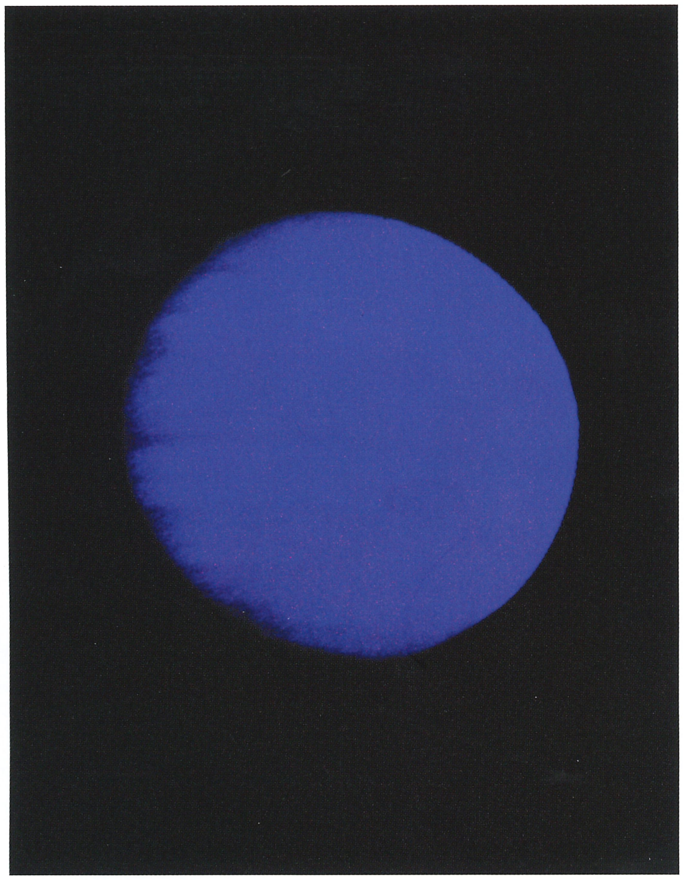

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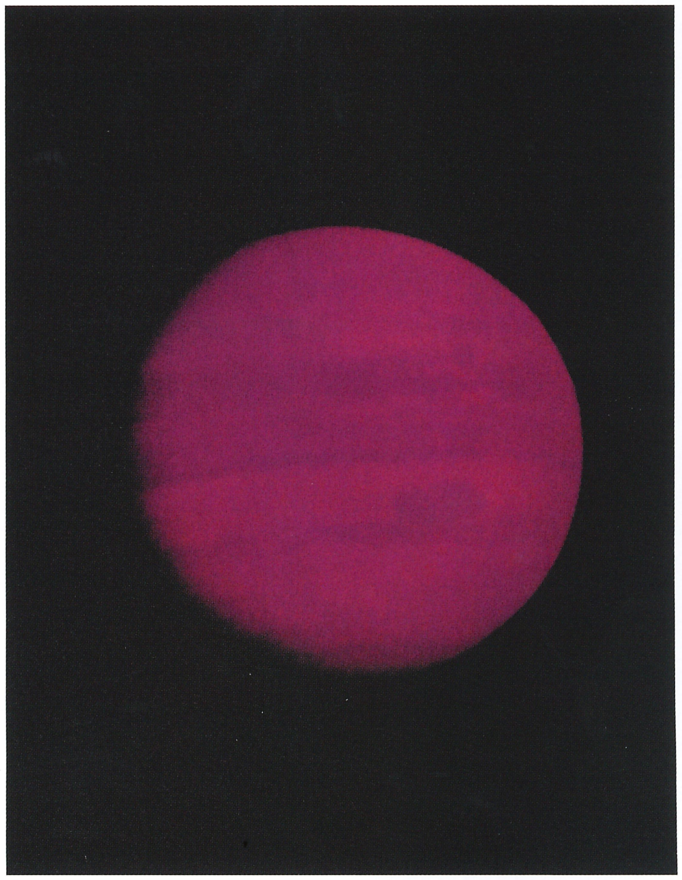

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2. (LEFT) Earth from Voyager 1 seven weeks after launch
3–6. Jupiter through the Voyager camera's color filters

7.

8.

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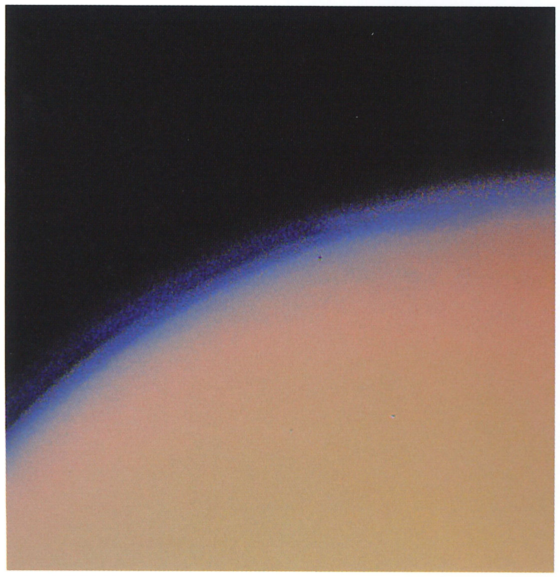

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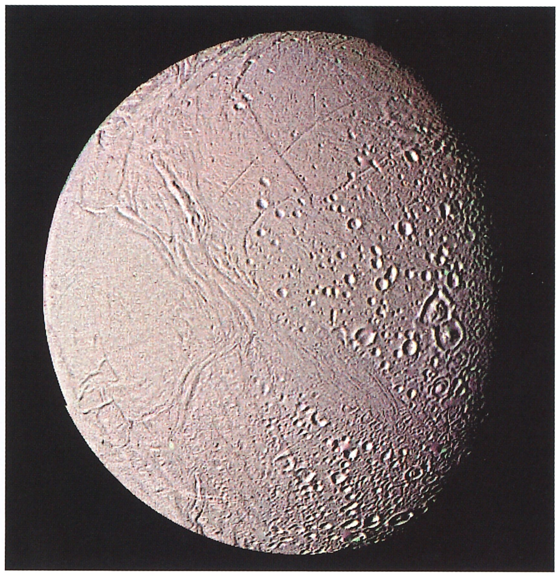

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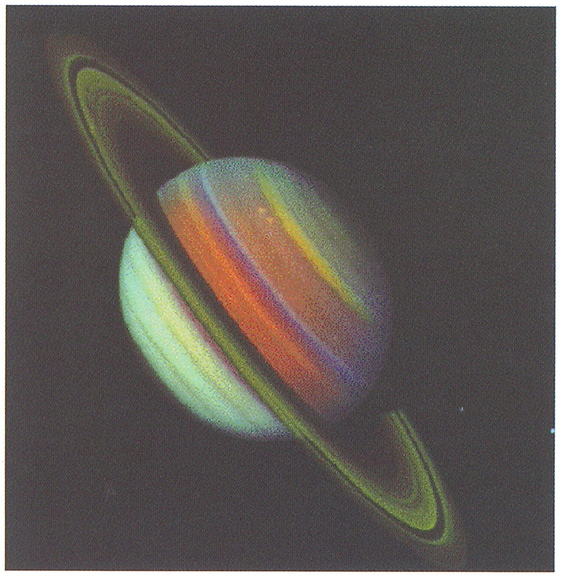

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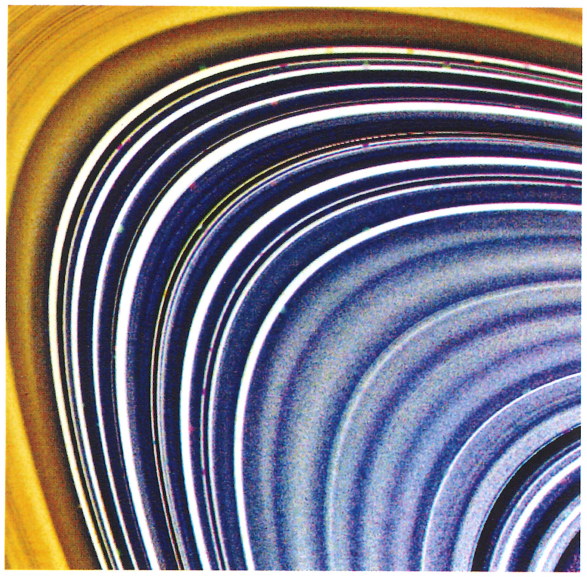

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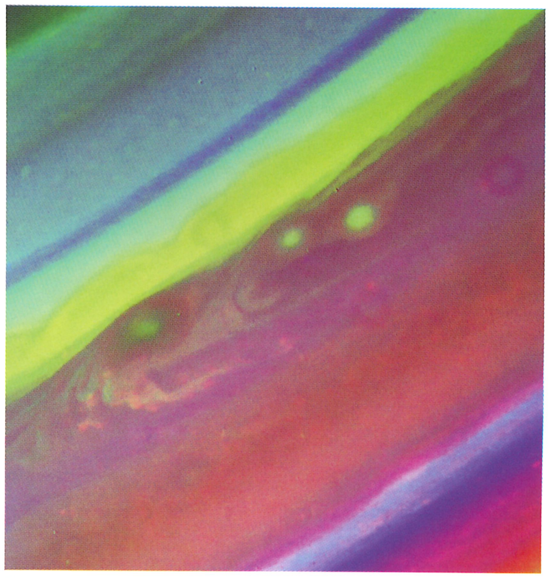

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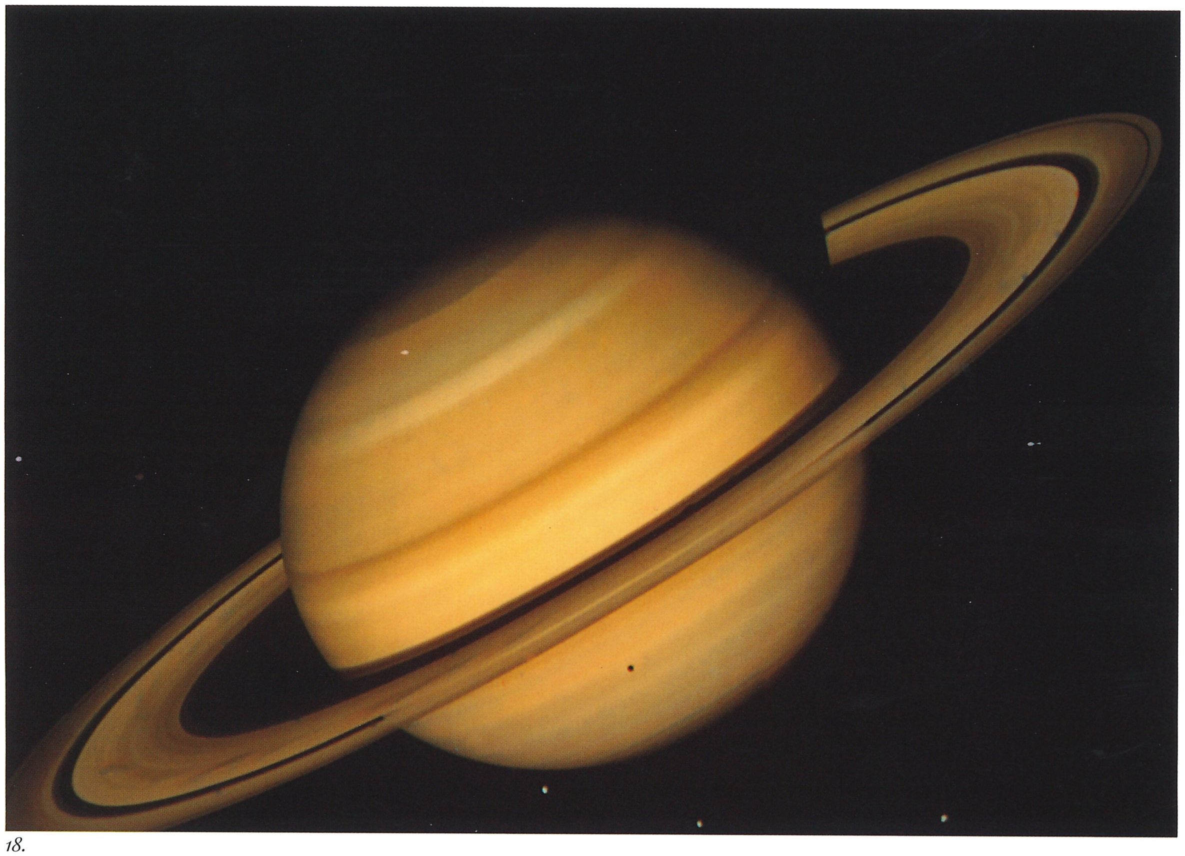

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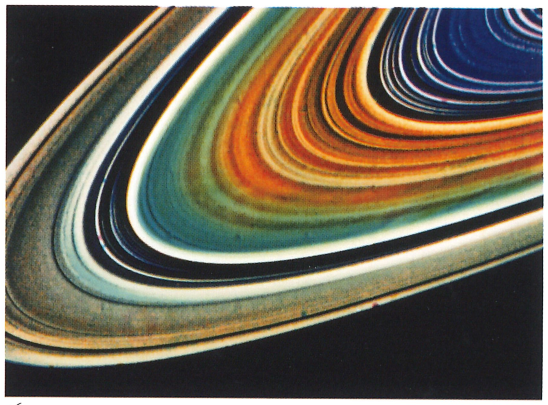

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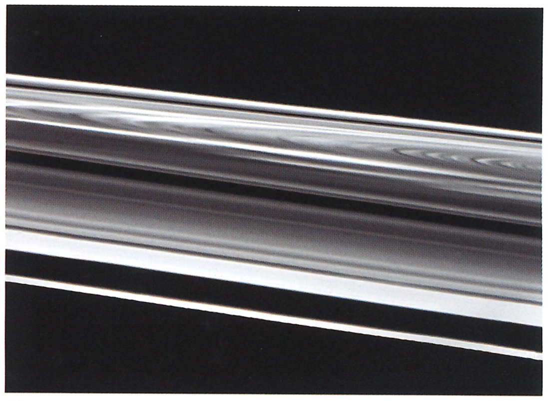
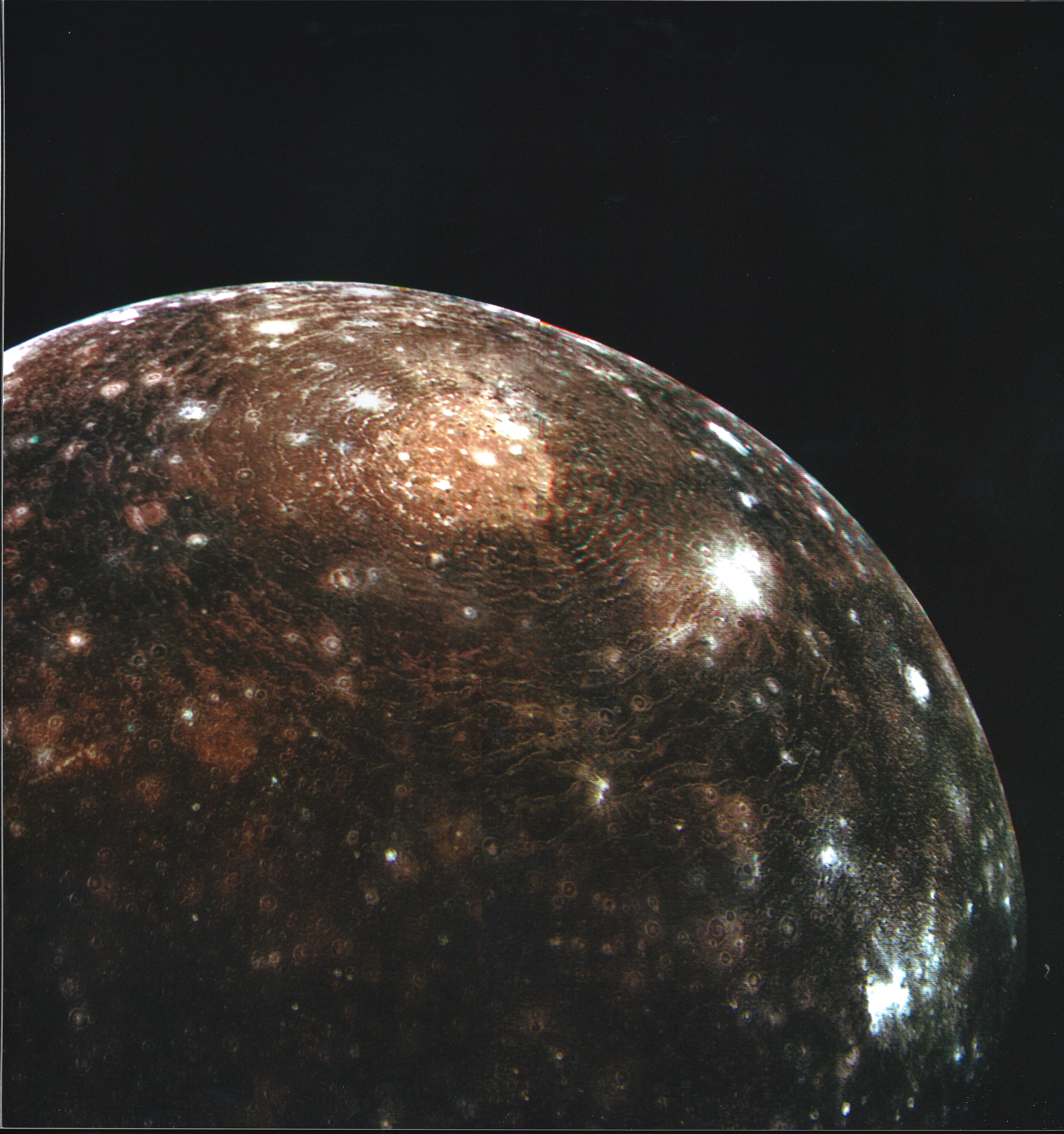
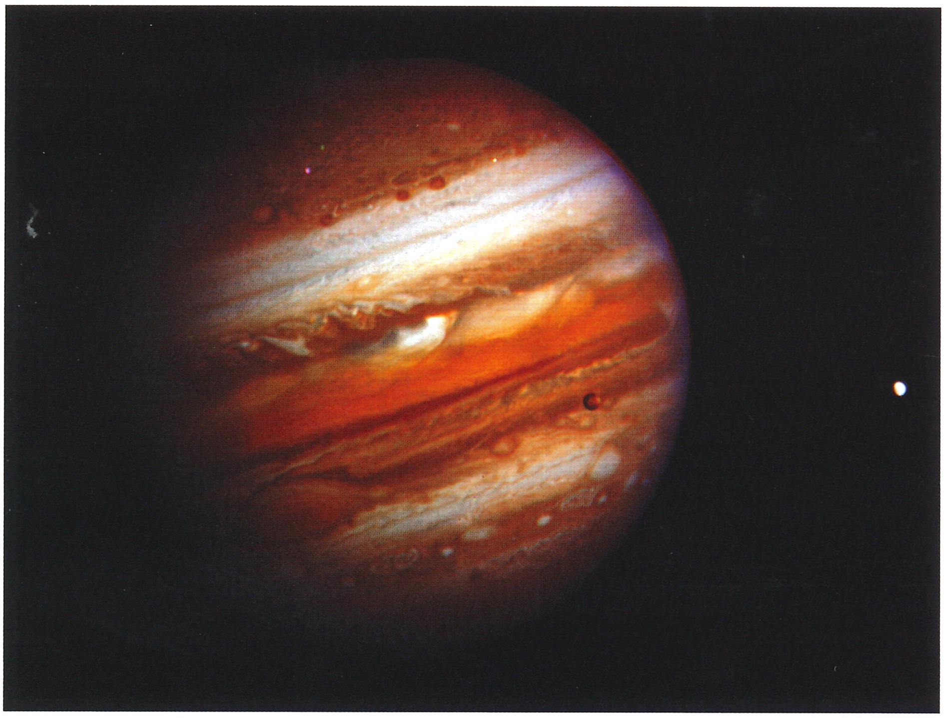


17.

7. Saturn
8. Saturn's moon Tethys
9. Saturn's moon Dione
10. Saturn's moon Titan
11. Saturn's moon Enceladus
12. False-color image of Saturn
13. Highly enhanced color variations of Saturn's rings indicate different chemical compositions
14. Saturn's rings with "spokes" of dust particles
15. Saturn's northern hemisphere
16. Saturn C-ring and B-ring with ringlets
17. Saturn's rings, wide-angle view
18. Saturn and three moons

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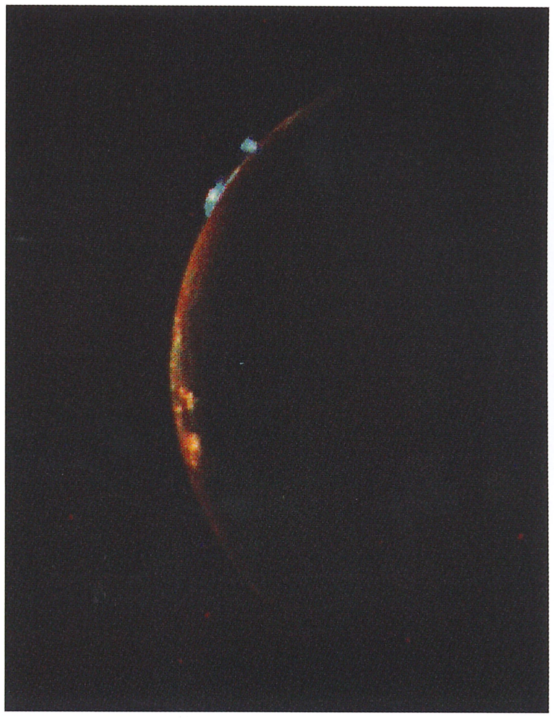
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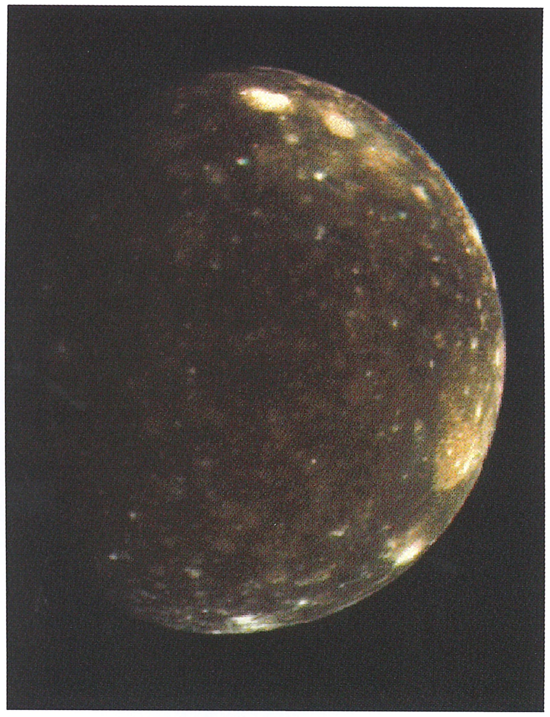
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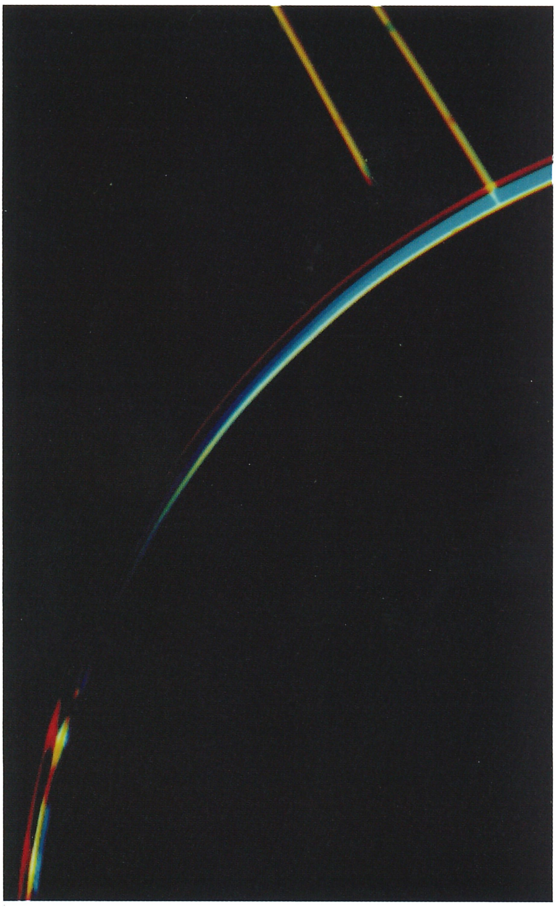
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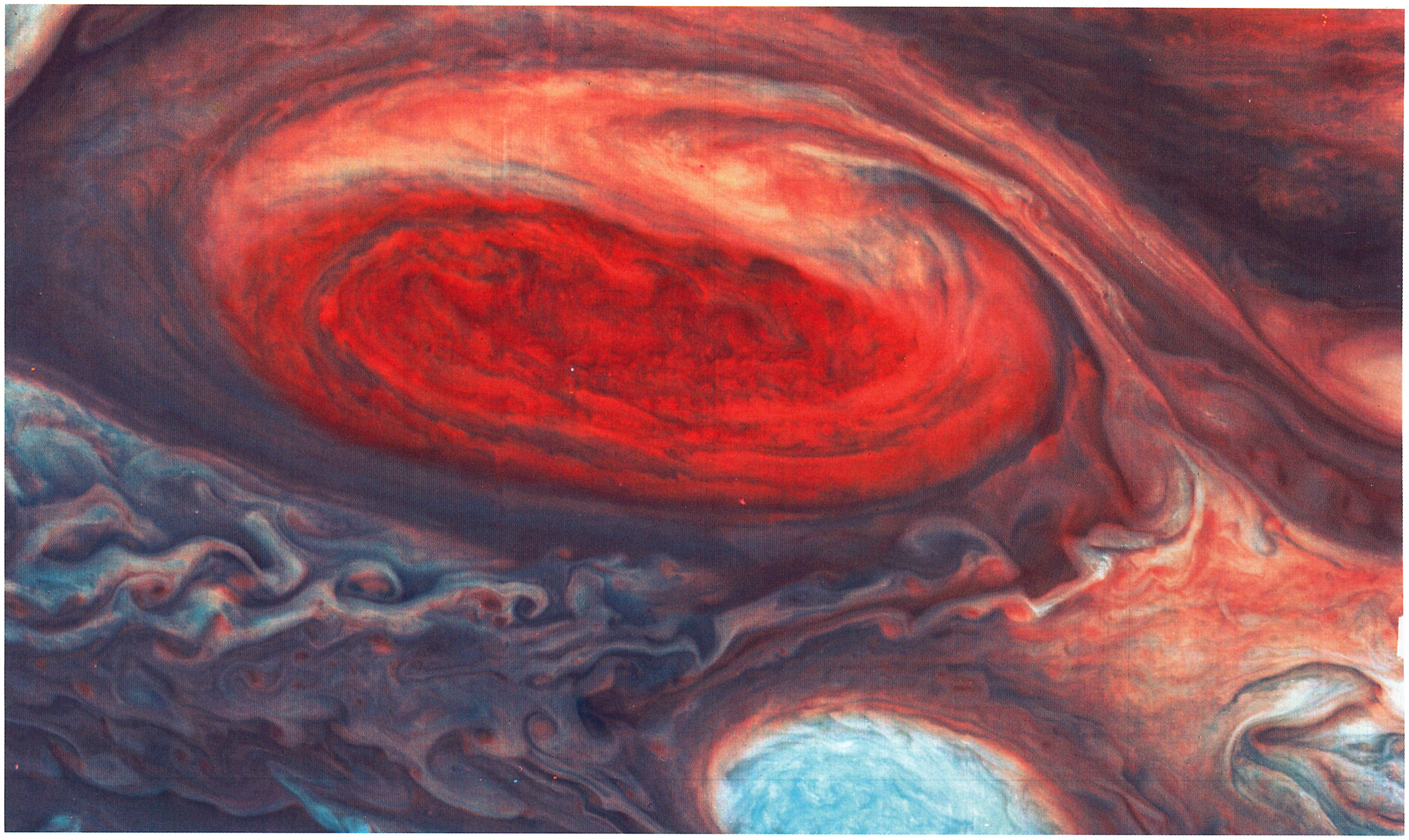
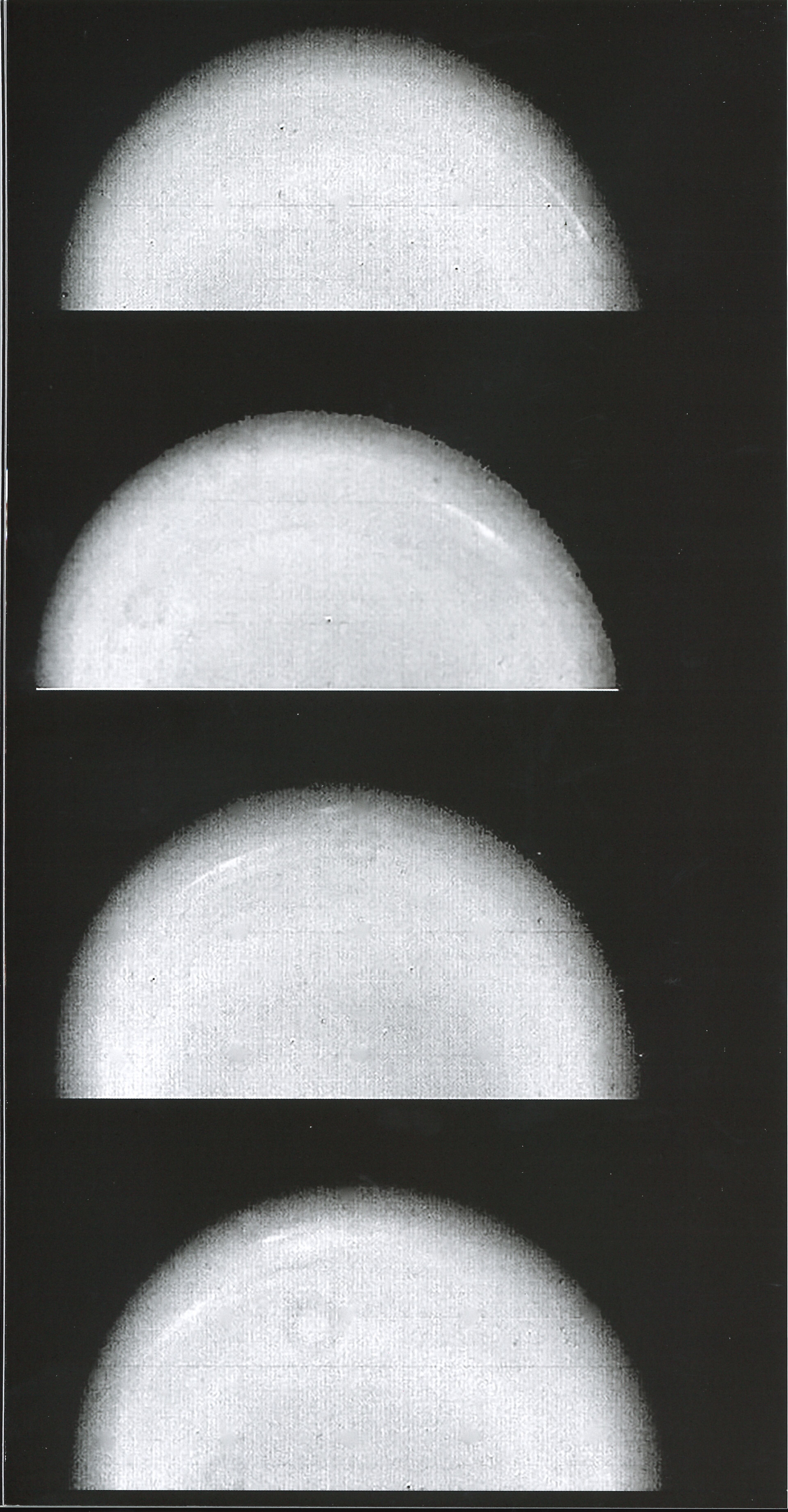

24.

19. (LEFT) Jupiter's moon Callisto from a distance of 350,000 kilometers
20. Jupiter and two moons
21. Active volcanoes on Jupiter's moon Io
22. Callisto
23. Jupiter's ring
24. Jupiter's Great Red Spot

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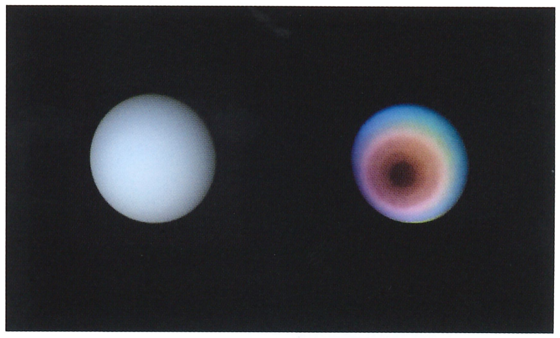
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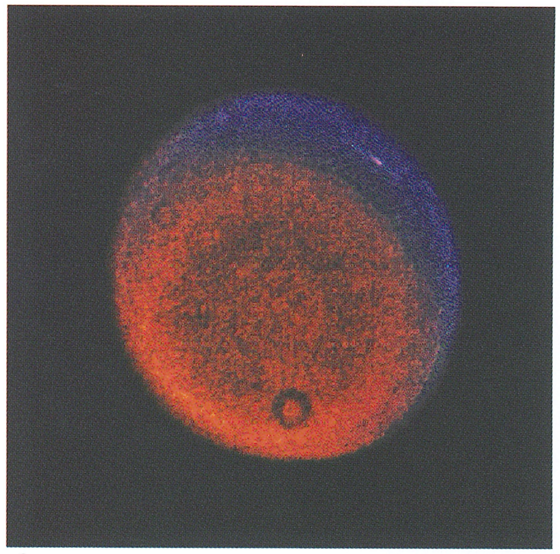
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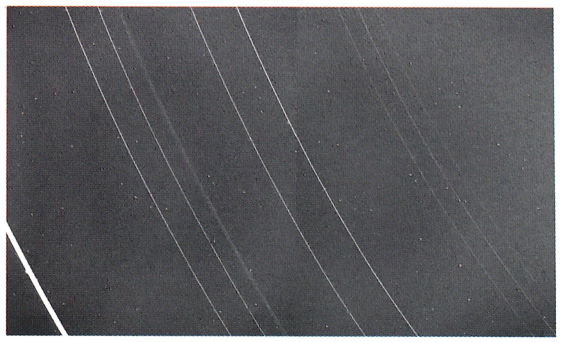
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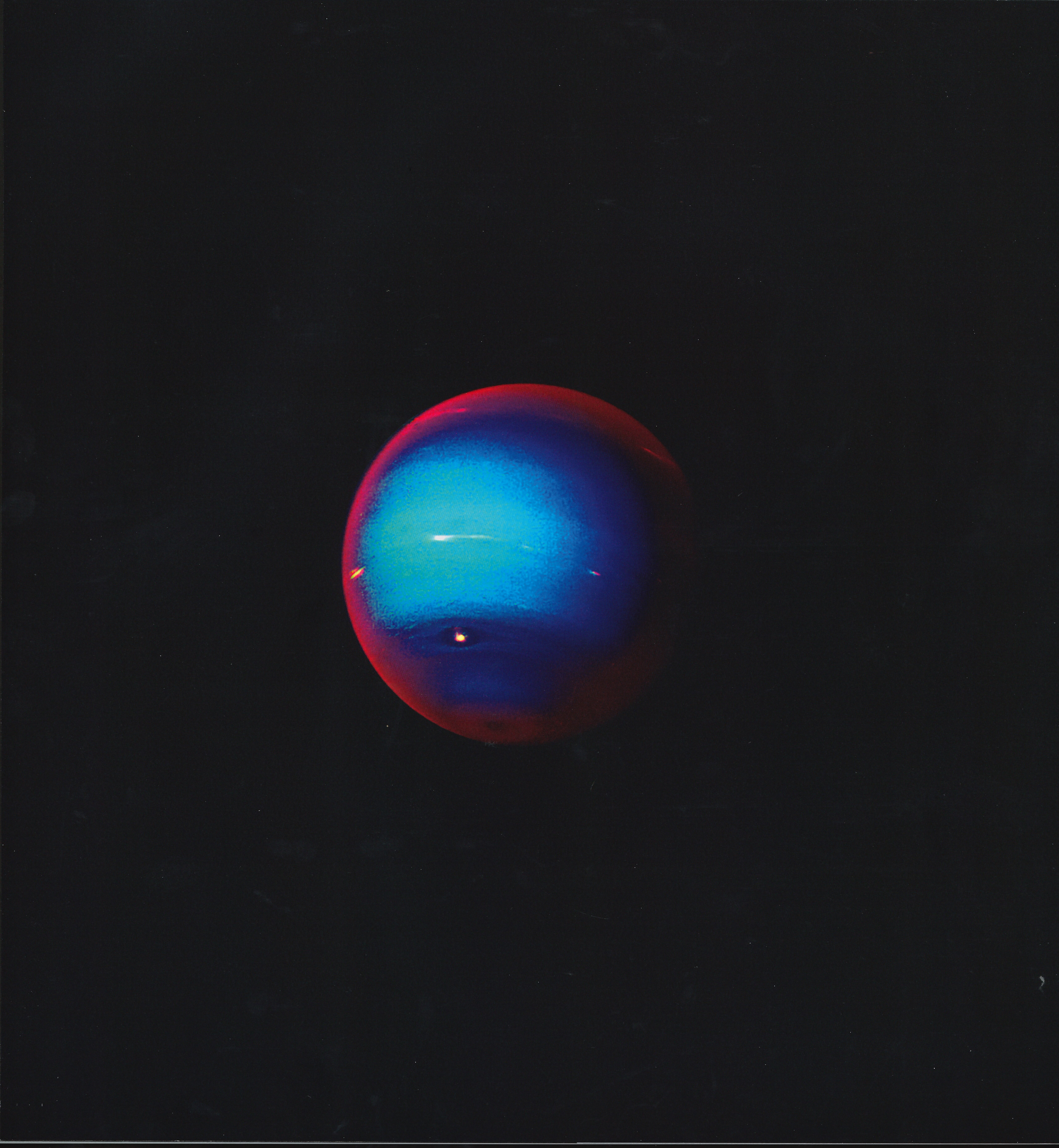
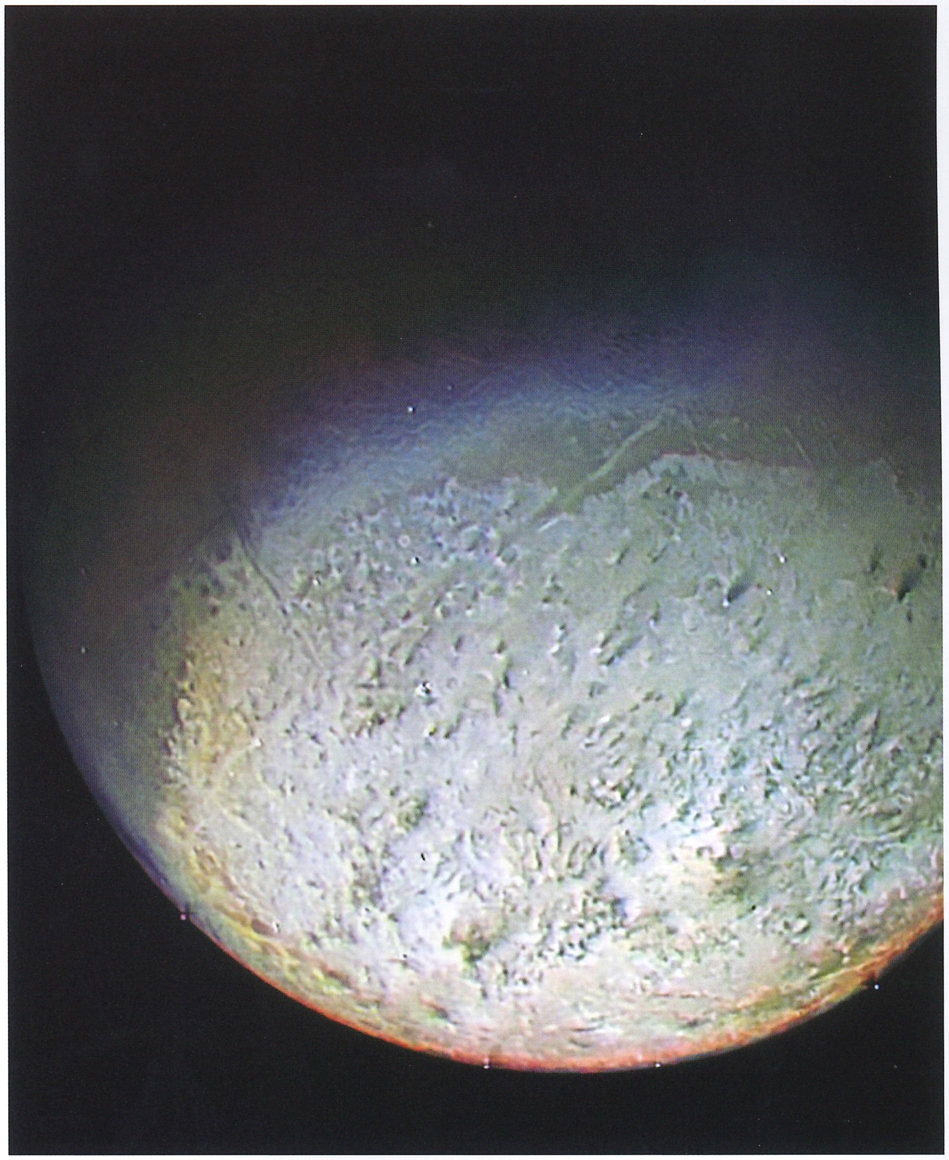
25. Time-lapse image of cloud movements in Uranus' atmosphere over 4.6 hours
26. Voyager 2's "farewell shot" of Uranus at a distance of almost 1 million kilometers
27. True-color (left) and false-color (right) images of Uranus
28. False-color composite of Uranus with visible discrete cloud in the upper right
29. Uranus' rings





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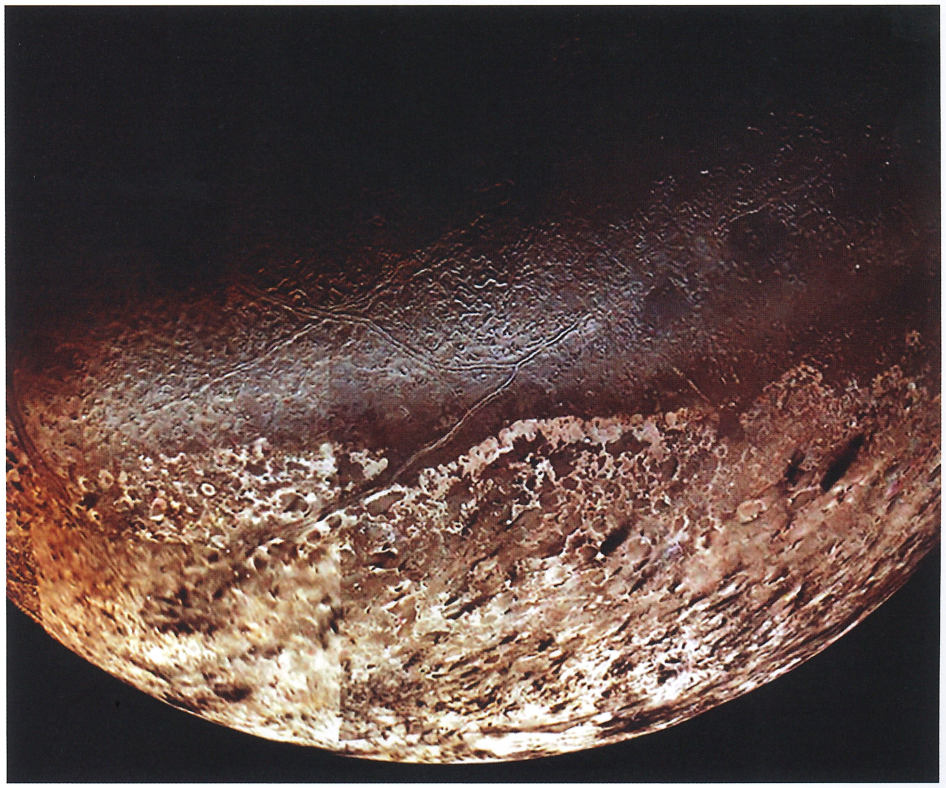

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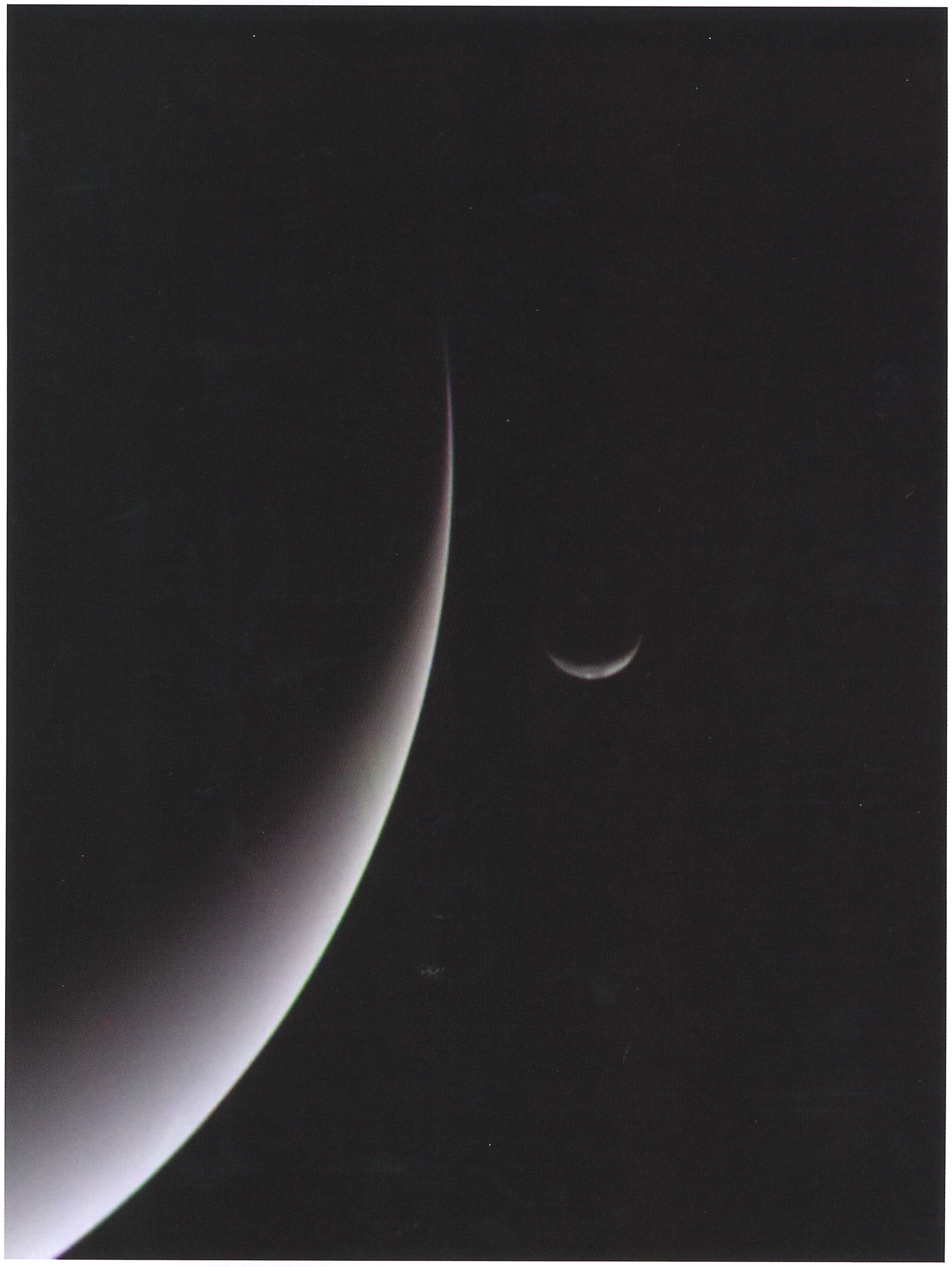
30. (LEFT) False-color image of Neptune
31. Bright southern hemisphere of Neptune's moon Triton
32. Triton



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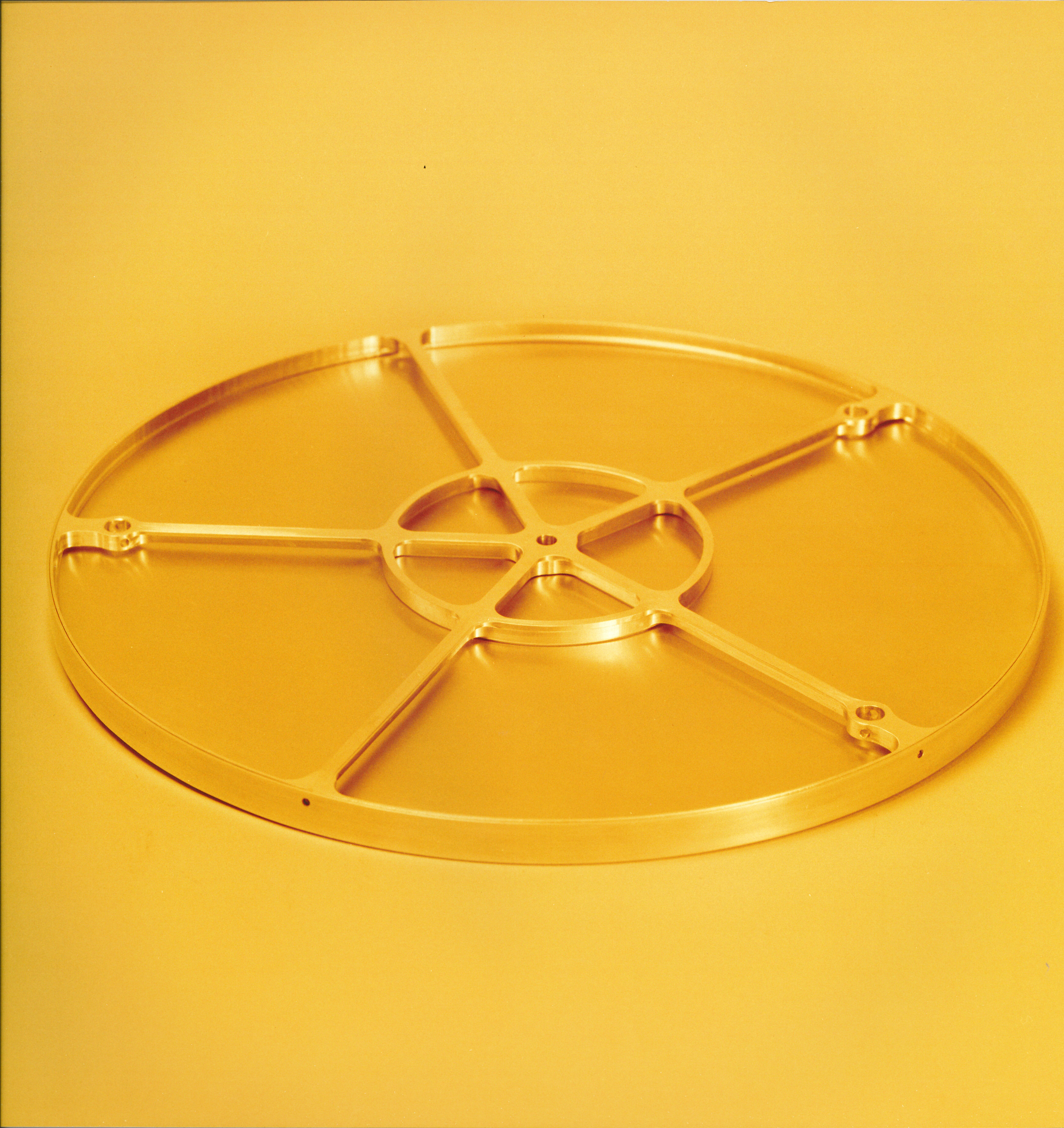
33. Neptune and Triton
34. Neptune's south pole



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Murmurs of Earth: The Voyager Interstellar Record (Ballantine Books, 1978) by Carl Sagan, Frank Drake, Ann Druyan, Timothy Ferris, Jon Lomberg, and Linda Salzman Sagan

The Interstellar Age: The Story of the NASA Men and Women Who Flew the Forty-Year Voyager Mission (Dutton, 2015) by Jim Bell

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We have the utmost respect and admiration for all the individuals whose sounds, images, and words on the Voyager Interstellar Record will carry the memory of our civilization long after we are gone.

Our deepest appreciation goes to our supporters on Kickstarter who made this wonderful journey possible. Thank you for joining us on this trip.

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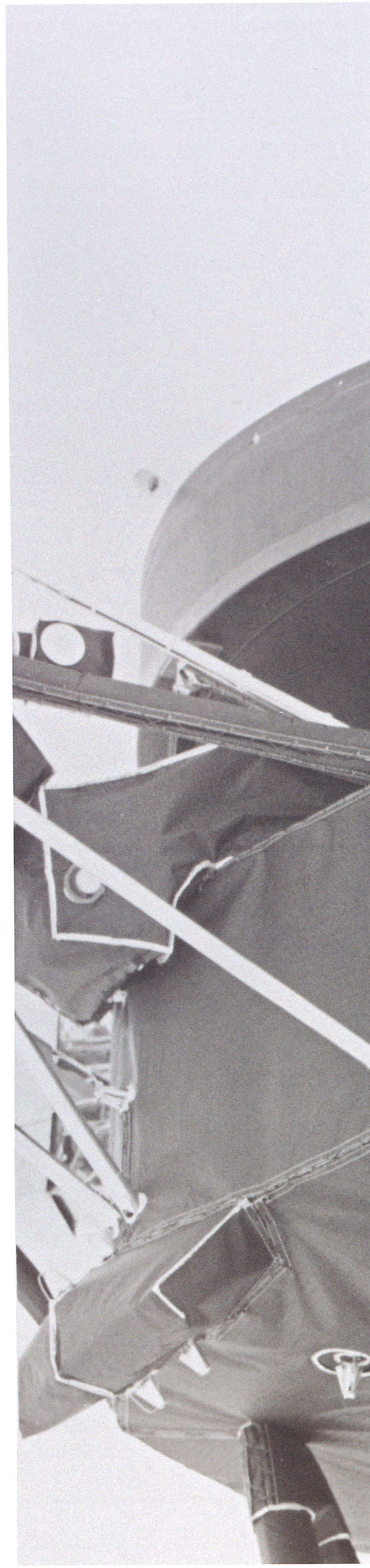

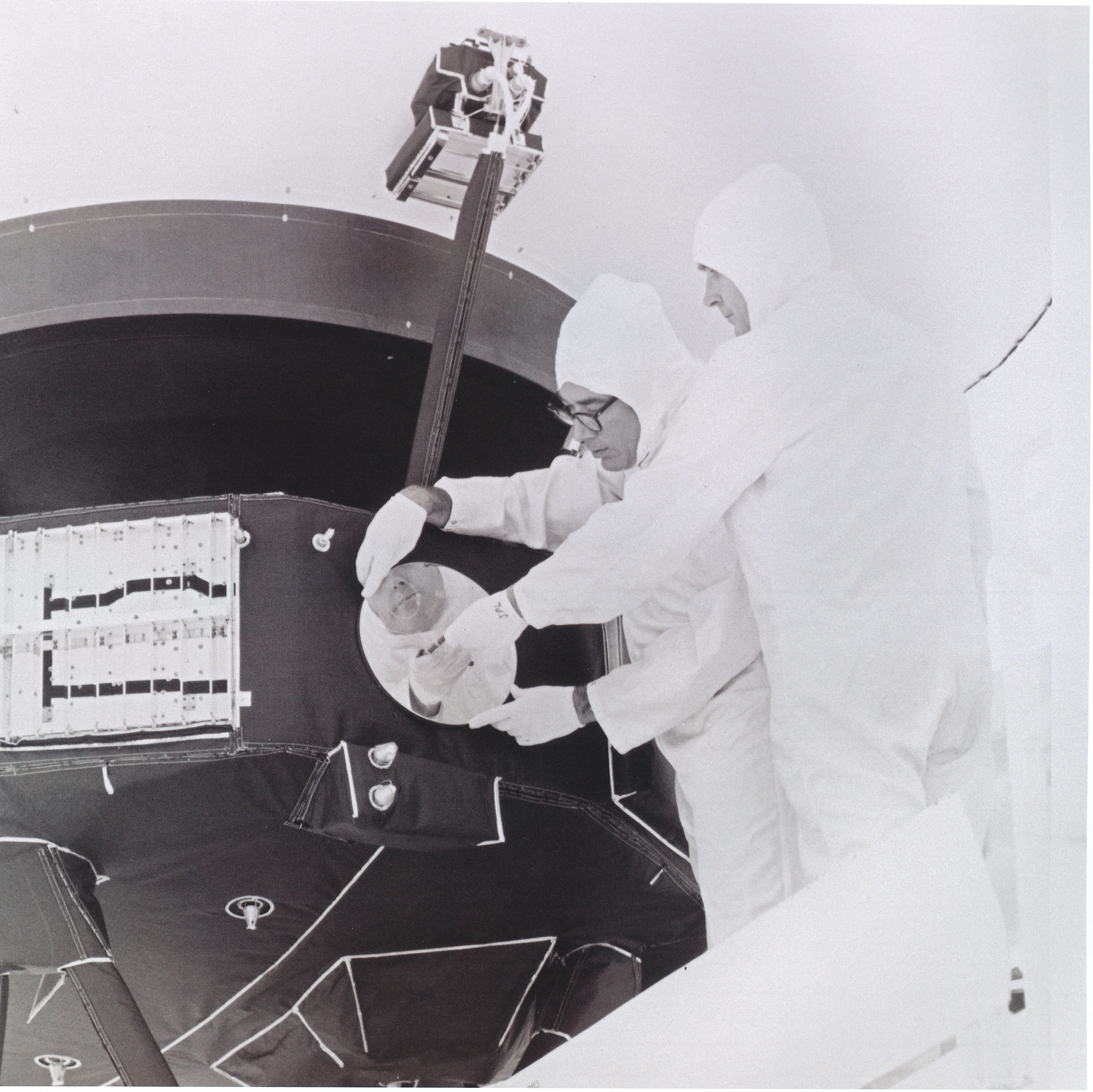
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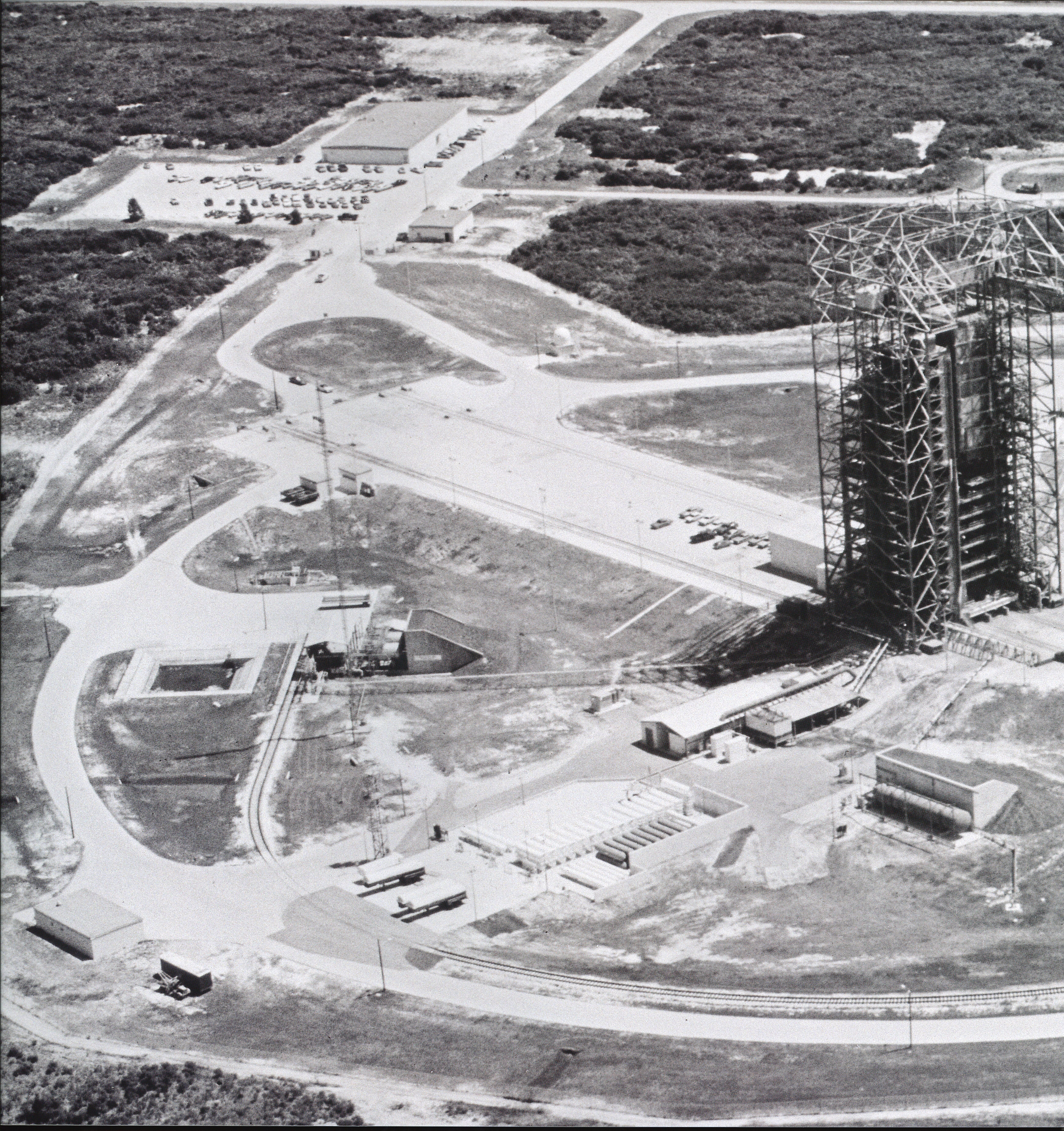
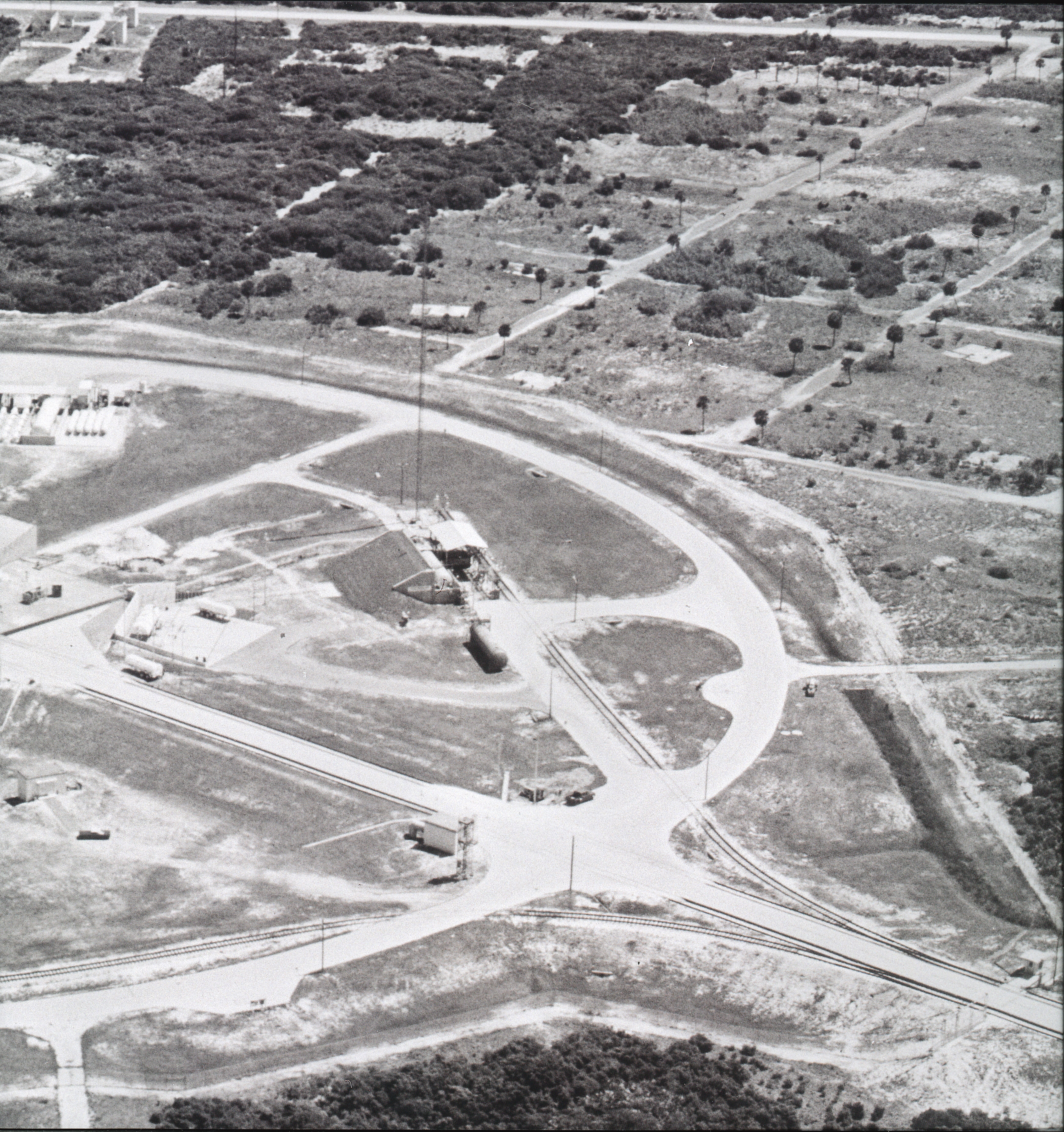
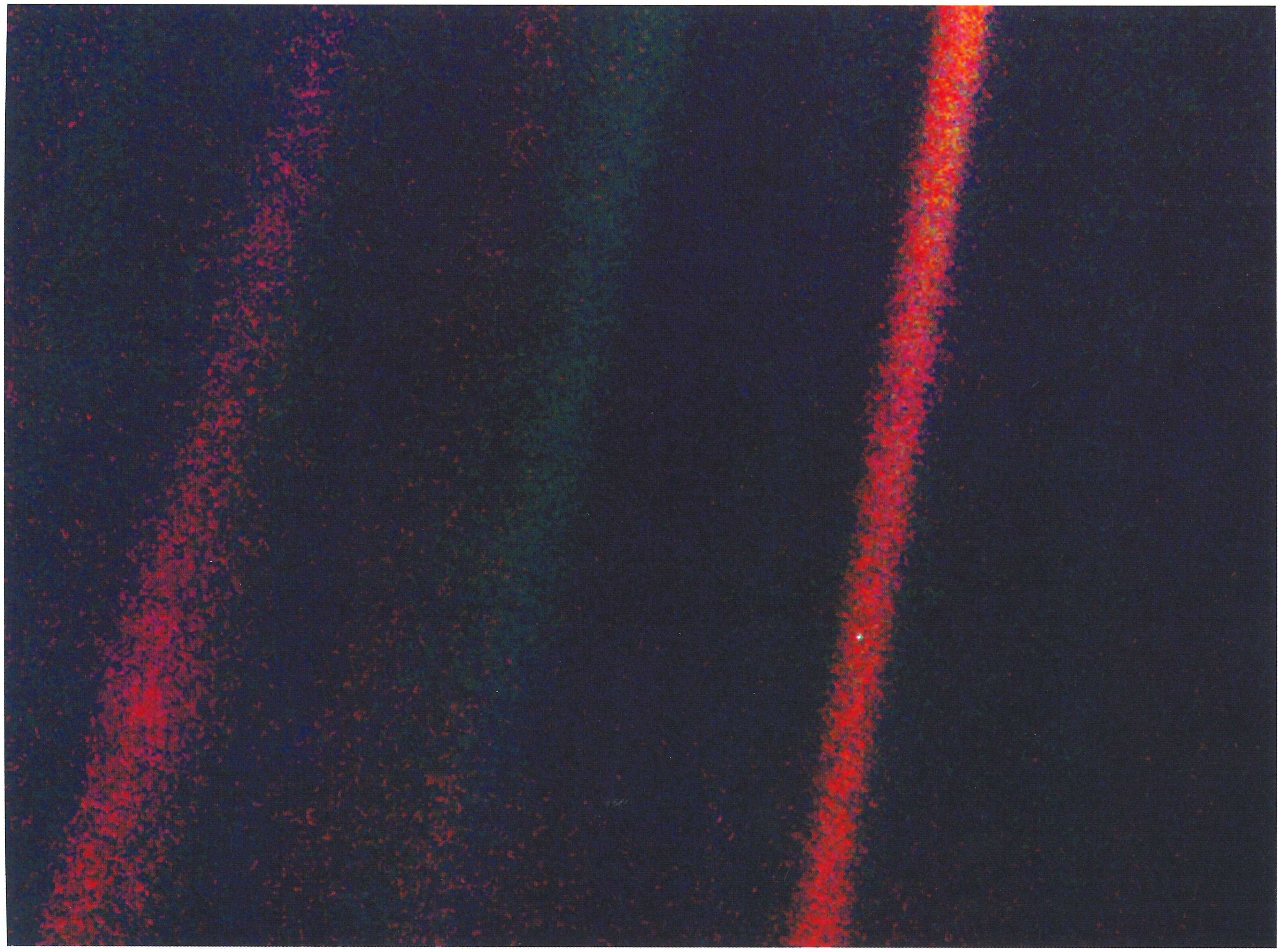
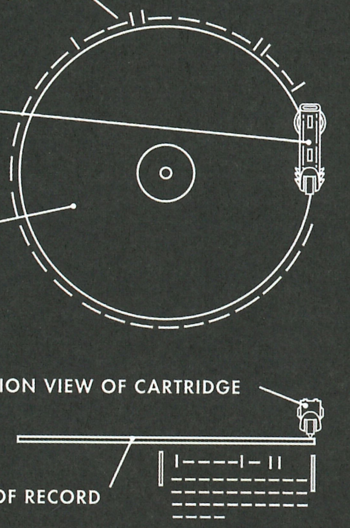


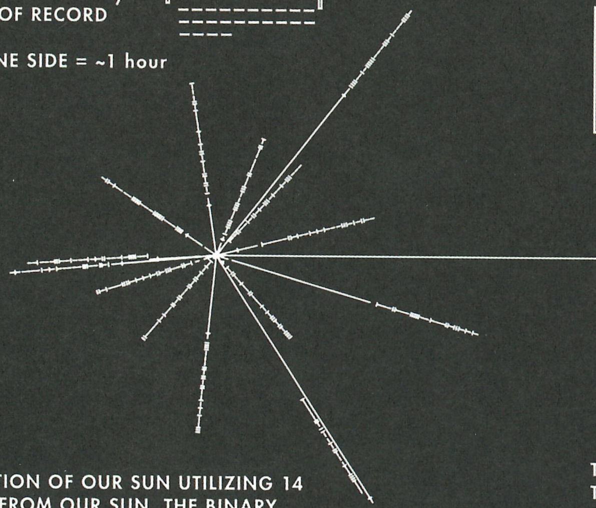




ABOVE: Earth as the Pale Blue Dot.
PRECEDING SPREAD: Cape Canaveral Air Force Station's Launch Complex 41 after the Voyager launches, Cape Canaveral, Florida.
FRONT COVER: The Voyager Interstellar Record's cover diagram explains where it comes from and how to play it.
FRONT ENDPAPERS: "Solar System Portrait"
BACK ENDPAPER: The identical Voyager spacecraft are outfitted with television cameras, magnetometers, infrared and ultraviolet sensors, plasma detectors, cosmic ray and charged particle sensors, nuclear batteries, and high-gain antennas pointed toward Earth.

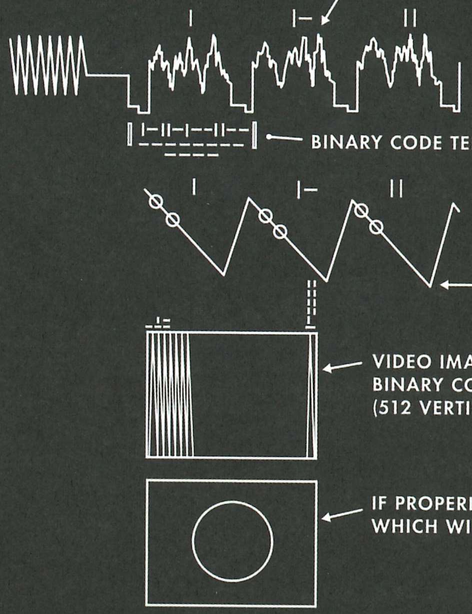
EXPLANATION OF RECORDING COVER DIAGRAM

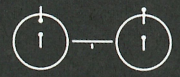




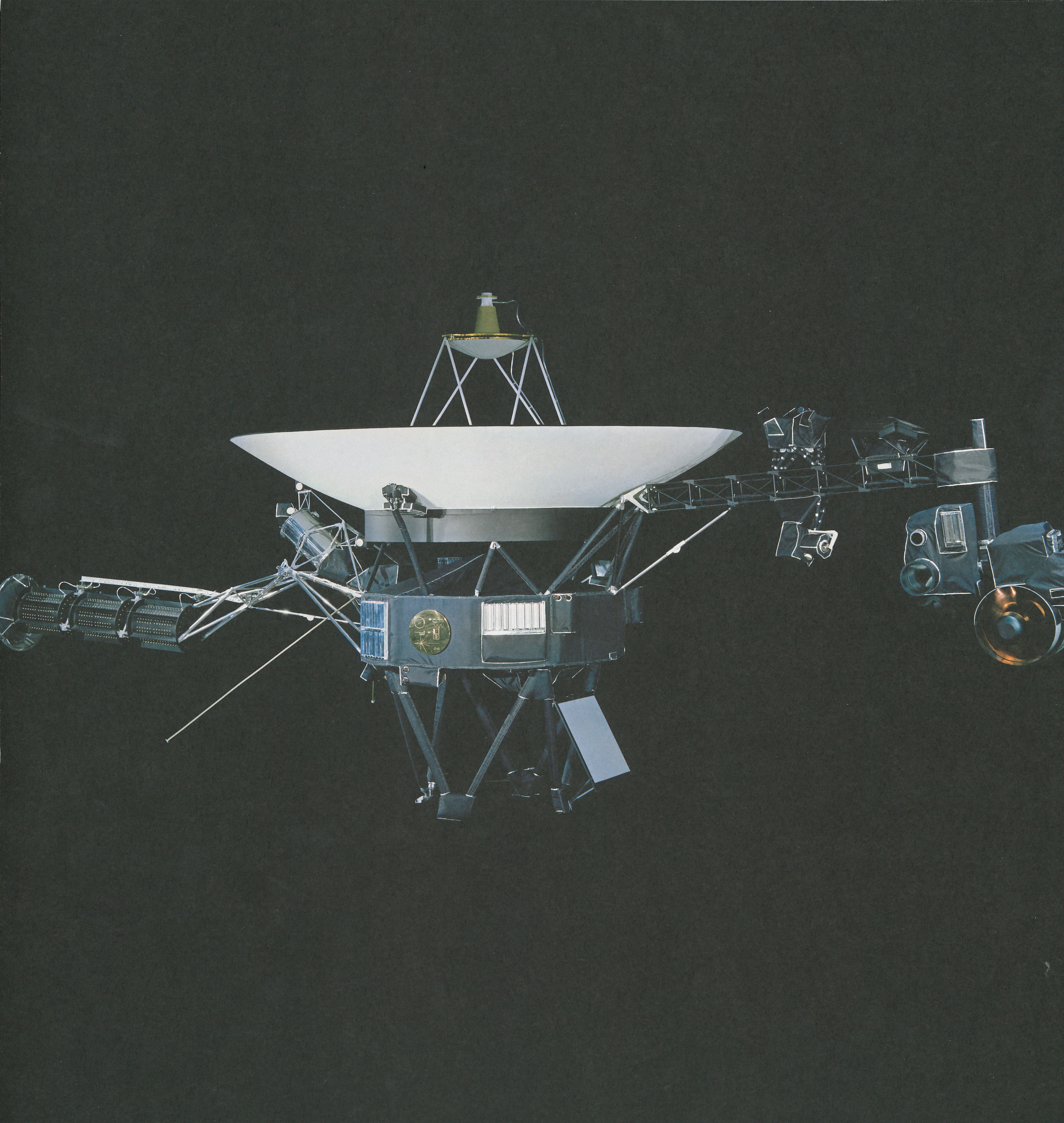
THIS DIAGRAM DEFINES THE LOCATION OF OUR SUN UTILIZING 14 PULSARS OF KNOWN DIRECTIONS FROM OUR SUN. THE BINARY CODE DEFINES THE FREQUENCY OF THE PULSES.

THE DIAGRAMS BELOW DEFINE THE VIDEO PORTION OF THE RECORDING





THIS DIAGRAM ILLUSTRATES THE TWO LOWEST STATES OF THE HYDROGEN ATOM. THE VERTICAL LINES WITH THE DOTS INDICATE THE SPIN MOMENTS OF THE PROTON AND ELECTRON. THE TRANSITION TIME FROM ONE STATE TO THE OTHER PROVIDES THE FUNDAMENTAL CLOCK REFERENCE USED IN ALL THE COVER DIAGRAMS AND DECODED PICTURES.




THE VOYAGER GOLDEN RECORD
DISC 1
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